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## MARKETING OUR PRODUCT.

BY H. V. CARPENTER,

Vice-President of the Society.

It is becoming a matter of common knowledge, among American manufacturers, that their foreign sales are limited, largely by their own ability to adapt their products to the habits of thought and special circumstances of those who buy. Close attention to these matters has not only aided them in selling their products, but has helped amazingly in securing those "repeat orders" which so surely identify the satisfied customer.

Our first conscious step, on any large scale, toward applying these ideas to engineering education, is now well under way through the activities of our Board of Investigation and Co-ordination. We have studied our present methods and the results, and will soon have an abundance of information regarding the different needs, ideas and special conditions of those with whom our technical graduates will find their life work. It is likely that this knowledge will result in some more or less fundamental changes, or, perhaps, increased freedom of election, in our engineering courses; to the end that our product may be better adapted to the customer's needs. It is likely that such changes will lead to a definitely greater percentage of our product "staying sold" and to a large increase in the "repeat orders." No one will doubt that when this result comes it can be looked upon as a definite increase in the over-all efficiency of engineering education.

There remains, however, an outstanding difference between the products of the engineering schools and the inanimate products of the technical industries. This difference lies in the natural variation in type and methods of thought of our men. This is such an important and highly valuable characteristic of humanity that it is decidedly undesirable for us

to smother out the individuality of the student and turn out a standardized product. Knowing as we do the wide variety of individual types of minds, should we not consider seriously any policy that will promote and develop the peculiar traits or abilities that appear in our students, and make some very serious attempt to analyze them and utilize them as guides in determining the type of work into which each man should go on graduation?

Most of us have been doing some thinking along these lines, but few have made a definite move toward personnel classification. On the whole, we have been leaving it to the employment agent of some large manufacturing corporation to classify and guide the men on the basis of, perhaps, a ten or fifteen minute interview. We must give credit to these men for developing some ingenious methods of character analysis, but why should we, who have contact with the young man for four or five years, leave the determination of the young man's future to a decision based on so little knowledge? The fact that the victim's innocence is usually such that he does not question the process, does not justify us in permitting its continuance.

## A SUMMER SCHOOL FOR ENGINEERING TEACHERS.

BY WILLIAM E. WICKENDEN,

Director of Investigation.

The recent survey of technical education in Europe showed the possibilities of direct borrowing from abroad to be relatively slight. Educational systems are organisms rather than dead machines. They evolve and are not merely assembled. They can not be transplanted piecemeal. However, when the writer found himself installed in the student's quarters at Oriel College, Oxford, as a guest of the English Board of Education and an unofficial observer at the Summer School for Engineering Teachers, he had the very lively impression that here, at last, was something that might be transplanted and take congenial root in American soil.

It will be recalled that British technical schools are of two general types, local technical colleges and divisions of universities. In a few instances the two types overlap through the incorporation of a local college into a university, as at Bristol and Sheffield. Many of the local colleges give some work of approximately university grade, but their chief function is that of continuation schools closely coördinated with local industries. Their teachers are, in most cases, recruited locally. Many of them are young men of admirable spirit but limited background, so that some form of upgrading process is fairly indispensable.

The universities are self-governing institutions and have no fiscal relation to the national treasuries, except for occasional parliamentary grants, and are quite independent of the national Boards of Education. The local technical colleges are maintained jointly by local educational authorities and the national treasury, and the national government has the right to impose educational standards and inspect the work done as the condition of financial aid. The two Boards of Education

seek to exercise this oversight wisely and tactfully, in a helpful and constructive manner. The inspectors are not bureaucrats but sympathetic counsellors. Their office resembles that of a bishop at his best rather than that of a military dictator. The authority is there and is used when needed, but otherwise kept in the background.

Both the English and the Scottish boards conduct summer schools for the teachers of the local technical colleges. The school maintained by the English board is held in two stages and occupies three weeks in all. The first stage is at the University of Birmingham which is outstanding for the variety and excellence of its equipment, and the second stage at Oxford for the sake of the intimacy of residence in a setting of great beauty and noble traditions. The first stage is devoted to laboratory work. Individual programs are laid out to supplement the past experience of each teacher, often gained under serious limitations. The best laboratorians of the universities are called in to direct the work and the tutorial system makes it an effective school of teaching methods, no less than a school of direct experience. Makers of laboratory machinery and instruments coöperate to make this stage effective as a contact-maker with the newer resources of the art.

The transfer to Oxford is made on a Saturday by motor car, going via Stratford so as to afford a pleasant and restful break in the middle of the program. At Oxford the group takes possession of Oriel College for ten days. Staff and students alike are quartered in the quadrangles, dine in the great hall, fraternize in the common room and experience to the full the characteristic intimacy of Oxford life. The program is planned with a view to capitalizing the social contacts. The young Englishman is shy and reserved. He needs just such a thawing to release the positive traits needed in successful teaching. When one remembers the limited backgrounds of many of these young teachers, the social touch and the intangible influence of the Oxford atmosphere are of incalculable value. The skill with which these intangibles are capitalized admirably typifies the essentially human and non-bureaucratic

spirit of the Board of Education, and more specifically that of one of the chief inspectors, Mr. A. S. Barnes, the director and moving spirit of the summer school.

The program at Oxford is divided into intermediate and advanced divisions for men of corresponding teaching duties. There are separate sections for mechanical and electrical engineering. The technical lectures and tutorial conferences are separate for the most part but the general addresses and the recreational and inspirational features are for all in common. The day's schedule runs like this: Breakfast, an ample and leisurely meal, at 8:30; first lecture, 9:30 to 10:30, second lecture, 10:45 to 11:45, tutorial conference, 12 to 1; lunch, also ample and leisurely, at 1; excursions and recreational features until tea-time at 4:30; freedom or informal tutorial conference, 5:30 to 6:30; dinner at 7:00; an inspirational address at 8:15; good fellowship in the common rooms or lodgings until 11.

The lecturing and tutorial staff are the pick of the university professors of engineering as judged by professional standing, personality, teaching power and reputation in research. There are also professorial lectures on the art of teaching by handpicked authorities in the field of educational theory who deal with general principles such as "The Essence of Teaching" and by handpicked engineers who deal with such concrete themes as "The Art of Choosing and Working Examples in Mechanics." There were several excellent addresses designed to put the younger teachers in touch with the progress of fundamental lines of research. The evening addresses are inspirational and broadening, with such notable speakers as Sir Henry Fowler, an outstanding figure in British railroading, and Sir Michael Sadler, the Master of University College, Oxford.

The school serves as one of the most important connecting links between the strong universities and the weaker local colleges, and thus tends to lessen some of the more unfortunate effects of the caste system in education from which Britain is slowly ridding herself. In general, the method and aim of

the school is to inculcate the art of teaching by direct example, by didactic exposition, by tutorial conferences on teaching practices, and by the direct interchange of experience between teachers. It aims equally through fellowship, environment and inspiration to give teachers a broader outlook on life and to help them work out an adequate philosophy of education in its relation to the modern problems of individual, economic and social life.

In considering the adaptability of a similar plan to American conditions the following suggestions might be taken into account:

1. In the absence of a national coördinating agency such as the Board of Education, the Society for the Promotion of Engineering Education might organize and conduct one or more such schools as a coöperative undertaking of the colleges.

2. Coöperation could probably be secured from the industries and the professional societies of engineers.

3. Initially the Committee on Teaching Personnel might foster such an undertaking as a major experiment in the present investigation.

4. It would probably be necessary to seek financial assistance from some outside source to carry the overhead expenses.

The Committee on Teaching Personnel has been asked to take these possibilities under advisement and is including them in its study of means of bettering our present situation as part of its program for the present year.

## SUMMARY AND REPORT, PROJECT Aa4.

### A STUDY OF ENGINEERING GRADUATES AND FORMER STUDENTS, NON-GRADUATES.

Data upon which the following report and summaries are based were obtained by means of questionnaire studies carried out through the coöperation of committees of the faculties of institutions which accepted an invitation to undertake the work. The forms used in obtaining and compiling the information are not reproduced but may be obtained from the office of the Director of Investigation, Society for the Promotion of Engineering Education, 33 West 39th Street, New York City. Data relating to the three divisions of the study were obtained from the following numbers of institutions and individuals:

(1) Graduates of the classes of 1922, 1923 and 1924—43 institutions and 3,933 individuals, representing 47.9 per cent. of those canvassed.

(2) Graduates of the classes of 1919, 1914, 1909, 1904, 1899, 1894, 1889 and 1884—34 institutions and 2,336 individuals, representing 35.2 per cent. of those canvassed.

(3) Former Students, non-graduates, of the classes of 1924, 1919, 1914, 1909 and 1904—14 institutions and 721 individuals, representing 21.5 per cent. of those canvassed.

The number of individuals represented in the first division is about fifteen per cent. of all the engineering graduates of the United States and Canada of the first three years stated and is probably a fair sampling of that body of graduates. The number of individuals in the other two groups is an uncertain but much smaller percentage of the entire body of older graduates and former students. It is doubtful whether the returns from former students are sufficiently complete to warrant other than the most general inferences.

The project was carried out under the sponsorship of the Committee on Engineering Students and Graduates:

R. L. Sackett, Chairman,
E. B. Roberts, Secretary,
Edward Bennett,
J. W. Hallock,
G. B. Pegram,
R. I. Rees,
H. P. Talbot.

The report of the committee is given in the following pages. A condensed summary of the results with comments thereon is also given. This summary is very much condensed from the original tabulations which may be consulted at the office of the Director of Investigation.

H. P. HAMMOND,
*Associate Director of Investigation.*

## SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.

### REPORT OF COMMITTEE ON ENGINEERING STUDENTS AND GRADUATES, JUNE 1, 1925.

This section of your committee's report relates to graduates of engineering and to former students who did not graduate. The bases of the report are the results of a questionnaire study undertaken at the invitation of the Board of Investigation and Coördination by a number of committees of the faculties of coöperating institutions. Individual questionnaires were sent by faculty committees to (1) recent graduates of the classes of 1924, 1923 and 1922, (2) to older graduates of the classes of 1919, 1914 through five year intervals to 1884, and (3) to former students—non-graduates—of the classes of 1919, 1914 through five-year intervals to 1904. The reports of the faculty committees were abstracted and summarized by the office of the Director of Investigation.

Data have been supplied by a sufficient number of representative institutions to warrant fairly definite conclusions as to recent and older engineering graduates; while the returns on the former students—non-graduates—are so incomplete as to justify only the most general observations. Upon this basis, your committee has given consideration to the following subjects developed by the report: distribution of engineering graduates as to general fields and special type of work; relation of field of work to course of study in school; earnings and progress of graduates; the placement process; opinions of graduates on engineering education; the continuation of study after graduation; and the former student—non-graduate—reasons for not finishing.

### Occupations of Graduates and Relation thereof to Courses of Study in School.

In Tables 1, 12, and 13 of the study of older graduates and 2, 8 and 17 of the study of recent graduates are exhibited the most reliable and comprehensive statistics yet obtained on the important and much discussed question of the actual occupation of graduates of engineering schools and the relation of lines of occupation to courses of study in school. Table 1 of the study of older graduates presents the general classification as to field of work of graduates who have already passed through the somewhat unsettled first five-year period, 25 per cent. in the definitely professional field, 41 per cent. in general industrial work, 16 per cent. in commercial work, 13 per cent. in governmental employ, and 5 per cent. in financial work. Insofar as any trend from one division to another is shown when graduates of longer standing are considered, the commercial and the professional group gain at the expense of the industrial group. On general considerations it seems unlikely that among the graduates of a given year more go into strictly professional work year by year, hence it is probable that this larger showing of the older classes in the professional group means that in former years the engineering graduate was more intent upon strictly engineering work, or else that for the older classes the replies were not representative, coming

more largely from the men who have stayed in engineering work, and who might therefore have been more interested in replying to the questionnaire. However, the distinctly upward trend shown in (12) of the study of older graduates in the percentages of those entering the consulting engineering field with advancing years (2.7 in 1919 to 18.8 in 1889) tends to corroborate this.

Referring now more particularly to the type of work in its relation to courses of study, we find for the recent graduates 59.6 per cent. in technical engineering, 11.5 per cent. in research and teaching, 16.2 per cent. in administration and sales work, 7.2 per cent. in clerical or manual work, and 5.5 per cent. in miscellaneous types of work. The varieties of work of older graduates show 22.5 per cent. in strictly technical work, 10.1 per cent. in research and teaching (note the slight variation from recent graduates), 63.9 per cent. in ownership, executive and administrative work including sales, and 3.5 per cent. clerical and miscellaneous. These figures show a healthy drift through technical work toward the responsibilities of management, and also indicate that engineering education to a satisfactory degree fitted the graduate definitely for his life's work.

Comparing the several branches of engineering on the basis of data given in (13) of Form 4D and (17) of Form 4B, the ratio of the number of older graduates remaining in the same or closely related line of work as their studies in school to the number of recent graduates so remaining, is:

| | |
|---|---|
| For Mechanical Engineers | 101% |
| Chemical Engineers | 99% |
| Civil Engineers | 83% |
| Electrical Engineers | 71% |
| Mining Engineers | 67% |

It appears that mining engineering has the least security of hold on the graduate. It is not clear what the smaller number of recent graduates in chemical engineering and mechanical engineering staying in those fields means, whether temporarily there is a smaller demand for them in their special fields or a larger demand in unrelated fields.

### Earnings and Progress of Graduates.

Table (2) of the study of older graduates shows a steady increase in the first year's salary except for the classes of 1889 and 1894 which corresponds to a period of profound depression in business. It would be of value to make a comparison of income increase in recent years with the decrease in the value of the dollar. For example, if we compare the entering salary of the class of 1914, $800, with that of the class of 1924, $1,476, on the basis of a sixty-three cent dollar to-day, to normal in 1914, the recent graduate is more than holding his own. The earnings for recent graduates seem to be increasing steadily and satisfactorily, their progress being something over $300 in annual salary per year. Extreme variations between graduates of certain institutions do not appear, certainly no greater variation than would be expected due to the varying economic conditions in different parts of the country. The progress of older graduates seems fair although the rate of increase of recent graduates is not maintained.

### Discussion of the Placement Process.

Graduates in engineering obtained their first positions in the following manner: Through a teacher or other official of the colleges—24.7 per cent., through the solicitation of an employer—20.5 per cent., through work done prior to graduation —15.7 per cent., through personal solicitation of employer by the graduates—14.3 per cent., through family connections—9.9 per cent., through the alumni of the colleges—6.8 per cent., through advertisement or employment agencies—5.6 per cent., and by other means—2.5 per cent. It will be noted that but 45.2 per cent. of all the graduates obtained their first positions through the organized efforts of the colleges or of employers.

The reasons given by the graduates for their choice of first positions are as follows: Because the work was in direct line of their college course or closely associated therewith—49.5 per cent., apparent good opportunities—25.8 per cent, only job available—9.7 per cent, desired location—8.7 per cent, good salary—3.6 per cent, and other reasons—2.7 per cent. The desire for the right sort of experience or of opportunity was evi-

dently of far more influence than all others, being 75.3 per cent. of the total. Contrary to general impression, perhaps, the question of salary was, ostensibly at least, a very minor factor. The figures show an excellent demand for men of engineering training.

The above relates to the first positions held. It is found that there is a very considerable shifting about from job to job among the recent graduates. Of the graduates of 1922, 57.0 per cent. have held two or more positions since graduation, and 25.0 per cent. of these have held three or more positions. Of the class of 1923, 39.5 per cent. similarly held two or more positions, and 13.0 per cent. held three or more. Even in a class graduating as recently as 1924, about 20 per cent. have held two or more positions since graduation. The high degree of turnover indicated by these figures shows an unwise choice of first positions in altogether too high a percentage of cases. Of the graduates who do change positions many do not remain long enough in their first job to gain much experience or even obtain a clear conception of its ultimate possibilities. An undue amount of time is wasted by these graduates before they are established in their life's work. This high percentage of turnover among recent graduates could certainly have been reduced, it is believed, by more effective vocational guidance in the colleges. It is one of the encouraging signs of the times that some of our institutions have realized this need and are meeting it through the introduction of personnel systems and the selection of personal advisors, either from among the faculty or individuals specially designated for the work, and through more informal means giving to prospective graduates reliable information as to the various lines of work open to graduates. It must be admitted however, that only a fair start has been made. It is also probably true that the methods employed by the industries in the selection of graduates are not yet as completely organized and scientific as they ought to be if the turnover of young engineering graduates in industry is to be reduced. Perhaps this is partly a problem of co-ördination of industrial and collegiate personnel methods.

In spite of the comparatively poor start made by many

graduates, it is gratifying to note that 77 per cent. express themselves as satisfied with their present jobs, and 81 per cent. as satisfied with their prospects, but even more important—that 95 per cent. of the graduates express a definite liking for engineering work and more of them, 98 per cent., feel that they made no mistake in taking an engineering course.

## Opinion of Graduates as to Features of Engineering Education.

The opinions of graduates seem to express general satisfaction with engineering education. As to the technical and scientific preparation for their work which they received in college, 76.6 per cent. state it was either good or excellent. The importance assigned to the various general divisions of engineering curricula make for logical and natural sequence with scientific and technical subjects scoring much higher than economic and cultural subjects. The only thing of special significance is that economic subjects are put ahead of cultural. While the engineer needs general cultural education just as he needs good character, it is the scientific and technical part of his education that prepares him for engineering rather than for something else. The outstanding criticism of engineering curricula is the lack of courses in business and economics. Of the recent graduates, 50.9 per cent. noted this as an important omission from their college courses, and in recommendations for improvements of in engineering courses, the inclusion of these courses also has a prominent place.

Opinions of older graduates as to the objectives of engineering courses were expressed as follows: To train broadly for the general needs of industry—20.6 per cent.; to train for specific needs of specialized divisions of engineering practice—11.9 per cent.; to provide the former type of training for the majority, but provide the latter type for those who desire to spend the additional time required—67.5 per cent. This latter general notion held by so many indicates great need of study of the provision made at our engineering schools in this respect.

## The Former Student—Non-Graduate.

As stated previously, the evidence before your committee on former students who did not graduate is not sufficiently complete to warrant more than general observations. On the basis of data available it would appear that about 60 per cent. of the non-graduates drop out of college before the completion of their sophomore year, and the average length of residence appears to be 3.7 semesters or 1.8 years.

The predominant reason for leaving college has been given as financial difficulty in 24.3 per cent. of the cases; scholastic failure in 22.7 per cent., while others follow with war service—11.7 per cent., voluntary change of course—10 per cent., lack of interest in engineering—9.9 per cent., health—8.0 per cent., and change in status of family—6.4 per cent. War service, accounting for 11.7 per cent. of the drop, is recognized as an unusual reason.

During the 1.8 years in college, but a small percentage of the men (5.3 per cent.) claim poor health; the remainder stating that they had good or medium health. It is not apparent that health can be held responsible for any marked portion of the drop. Their participation in college activities (66.3 per cent. report moderate or considerable activity) appears to have been considerable, particularly for men in the younger years, when they are not so likely to have become identified with college activities. The extent to which they were self-supporting does not appear to stand out beyond that of any other group of students. Complete self-support is reported by 24.3 per cent. and more than half support by 19.2 per cent. The remainder were self-supporting only to a small degree or not at all. The committee has not yet been able to reconcile these statements with financial difficulty as being the leading reason for leaving college. It appears probable that financial difficulty as a reason for leaving college may have been unconsciously emphasized in the minds of some for scholastic difficulties.

Of the causes of scholastic difficulty into which detailed inquiry was made, it appears that 55.6 per cent. of the men

acknowledged their difficulty to have been either poor scholarship or lack of aptitude on their own part. The blame was put on the school or the teachers by 23.2 per cent. with such expressions as "Poor arrangement of the Courses," "Poor presentation of the Subject." The failure of 10.0 per cent. more was found to be in the outside demands on their time such as the necessity for self-support and the time spent in commuting. Contrary to the usual opinion, at least in the minds of the non-graduates themselves, social diversions, athletics and college activities have played a negligible part in the failures.

In analyzing the subject with which the greatest difficulty was experienced, it is found as probably expected, mathematics leads the list and that is followed by the sciences and language. Mathematics or science is reported by 79.2 per cent. of the non-graduate students as the subject with which the greatest difficulty was experienced. In general, the findings of faculties as reported by the committee on entrance and elimination agree with the facts here set forth.

### Continuation of Study of Graduates.

The data on this subject is enlightening and seems to give evidence of a satisfactory carrying on of the intellectual stimulus received at college. Among the older graduates a gratifying number continued graduate work in a college or university—10.1 per cent. Of the remainder 31.4 per cent. have been devoting time to systematic study either under supervision or self-regulated. Such unsystematic study as the requirements of work have demanded has been carried on by 46.3 per cent. Only 7.6 per cent. admit no study along technical lines.

Of the recent graduates the following facts are briefly given: 76.6 per cent. of the positions occupied are such as to require study, while 23.4 per cent. are not. Of those requiring study, 67.7 per cent. are such as to require the student to continue along the specific or general lines of his college course. Approximately one third of the studying is done under the supervision or direction of employers, while two thirds of it is not.

In two thirds of the cases of positions which did not require study, the graduates have nevertheless continued more or less systematic pursuit of some line of study. About 55.7 per cent. of our graduates have continued their interest in the study of cultural subjects including literature, art, psychology, sociology and the like. Here is evidence of systematic effort on the part of the graduate, the assumption of some measure of the responsibility of supervision by the employer, and a small contribution by the extension divisions of our colleges and universities. It might well be a matter for serious consideration whether or not our engineering schools should exercise more control over the intellectual life of their graduates by insuring well directed study and a maximum result for the time and energy expended.

## Conclusion.

From the above discussion and the consideration of the data presented, it seems to your committee that there are several outstanding problems worthy of study by this Society and the engineering schools and colleges of the country.

1. Study and development of better methods for guidance of graduates into industry.
2. Possibility of supervision of technical studies of graduates in industry by engineering schools.
3. Consideration of the expressed demand for more economic training in engineering curricula and better training in English.
4. Consideration of the scholastic difficulties, which student and faculty agree are the chief obstacle to graduation of former students, with a view to decreasing the number of eliminations.

For the Committee:

R. I. Rees,
G. B. Pegram,
E. B. Roberts.

## Summary of Data—Engineering Graduates and Former Students, June 1, 1925.

*Part 1: Graduates of the Classes of 1922, 1923, and 1924.*

*Number of Positions Held Since Graduation.*—These results show not merely different positions held in one firm but represent essentially the shifting of graduates from one firm or type of position to another during the period of adjustment following graduation.

*Relationship of Fields of Work to College Course.*—The "same field" has been taken as the general fields of chemical, civil, electrical or other engineering and their usually recognized major divisions. The "same field" in civil engineering, for example, includes highway engineering, municipal engineering, sanitary engineering, etc. "Allied fields" are those closely allied to the major fields. "Unassociated engineering field" may be illustrated by the case of a graduate of civil engineering who is practicing in the field of electrical engineering. Industrial engineering is taken as allied to chemical, civil, electrical and mechanical engineering. "Non-engineering fields" are those which are not closely related to engineering work. The sums of the percentages of graduates working in the same fields or allied fields for the five major divisions of engineering are as follows:

| | |
|---|---|
| Civil Engineering | 85.8% |
| Electrical Engineering | 80.3% |
| Mining Engineering | 74.6% |
| Mechanical Engineering | 62.0% |
| Chemical Engineering | 61.2% |

*Types of Positions Held.*—The graduates were asked to indicate the primary and secondary aspects of their work by placing figures one, two, etc., opposite a list of designations. Both the primary and secondary aspects of work are tabulated. It will be noted that the recent graduates are essentially in technical activities, including research and teaching, since a total of 71.1 per cent. indicate these lines of work. Research and teaching have been grouped together since it is for this type of work that the highest form of engineering education is usually assumed to be necessary.

*Means of Obtaining First Position and Reason for Choice thereof.*—It is to be noted that only a comparatively small number of graduates—12.3 per cent.—choose positions because of salary or location of work, whereas, 75.3 per cent. apparently made the choice because of the nature of the work or the opportunities which it seemed to offer. An interesting comparison can be made of these figures with the number of graduates holding two or more positions since leaving college.

It is also to be noted that less than half of the graduates obtained positions through organized efforts of the colleges or employers.

*Type of Work Done Since Graduation.*—In interpreting these figures it must be remembered that the results are based on returns from approximately 47.9 per cent. of the individuals canvassed. It is, therefore, possible that less than 82.4 per cent. of the graduates have been in engineering work continuously since graduation.

*Earnings Since Graduation.*—These figures are the medians of the figures reported by the graduates. It is believed that the central tendency of earnings is shown accurately. The number of members of the three recent classes reporting earnings is over 1,000 in each case.

Variations in the earnings of graduates from various institutions are comparatively small. Minimum and maximum median earnings reported by institutions are as follows:

| | | |
|---|---|---|
| Class of 1924, minimum | $110 | per month |
| maximum | 175 | " " |
| Class of 1923, minimum | 130 | " " |
| maximum | 219 | " " |
| Class of 1922, minimum | 140 | " " |
| maximum | 250 | " " |

*Study Since Graduation.*—The percentages are based on the numbers answering the various questions and not upon the total number of individuals who returned the questionnaire. In each of the four questions relating to study since graduation a number of the graduates did not submit answers. Some care should, therefore, be taken in using the quantitative statements of results.

*Opinions of Recent Graduates as to Cultural Studies.*—The opinions of the graduates as to the value to them of cultural subjects in college forms an interesting contrast with the statements obtained from entering students as to their interest in the same subjects at the time of admission to college. (See Summary of Study of Engineering at the Time of Entrance to College.)

In asking the graduates to indicate the lines of cultural interest maintained since graduation no definition of the word "cultural" was given. The answers may, therefore, possibly indicate types of interests which are not directly connected with the graduate's daily work. Under "miscellaneous" a great variety of interests were given, including such diversified ones as military training, social work, dramatics, etc.

*Reactions of Recent Graduates as to Present Positions.*—One of the most gratifying results of the project is the large proportion of graduates who feel that they made no mistake in studying engineering and find a liking for the work after giving it a trial. In interpreting the figures, however, it is to be noted that from four to ten per cent. of the graduates did not reply to the various questions.

*Omissions from College Course.*—In interpreting these figures it must be remembered that all graduates are included in the summaries irrespective of their lines of work or types of positions. At a later time an effort will be made to determine the relationship between types of omissions listed and types of positions or lines of work held by those giving the answers. It does not follow, for example, that the same emphasis would be placed on commercial or business courses by graduates of all courses. It is impossible, of course, to determine how much of the expressed desire for more business or commercial training lies in an actual need of such training in connection with positions held; or, on the other hand, how much of it may be dependent upon the thought that more training of this type might lead to more remunerative employment or more rapid advance to positions of responsibility. It must also be remembered that the type of employment bears on the nature of the replies on this matter.

*Subjects Considered Unessential.*—Definite replies to this question were obtained from only about one sixth of the graduates. A majority left the answer blank and a number stated that no subjects were considered unessential. Nearly half of the replies given are so scattering as not to be significant. Subjects included in these scattering replies covered the entire range of engineering curricula, but in most cases only one or two graduates indicated major engineering or scientific subjects. In interpreting the replies on modern languages it must be remembered that a number of the colleges which circulated the questionnaire do not require modern languages in engineering courses. It must also be remembered that graduates of all courses supplied answers and this must be considered in interpreting the replies as to the unessential nature of shopwork. In summaries received from a few institutions it was specifically noted that graduates who considered shopwork unessential were for the most part electrical or civil engineers.

*Opinions as to Possible Improvements in Engineering.*—There follow selected quotations from suggestions given by graduates as to possible improvements in engineering courses.

> "I consider that the field of greatest service of the University is in *vocational guidance* based on a thorough and scientific knowledge of vocational psychology. To me, the greatest of all tragedies is 'the square peg in the round hole.' I know, for I have been one. The greatest work a college of engineering can do, in my estimation, is to study the man, his *inclinations* and native abilities and then start him right, whether his field of real usefulness is engineering, sales work, or scenario writing. A right start is a fortune in itself."
>
> "Students should be given more explicit information in regard to the different branches of engineering. For example, I never knew the many departments in which an engineer may be employed until it was explained to me by representatives of concerns doing college recruiting. This information, coming as late as it did, caused me to make a hasty and unwise decision in choosing my work."
>
> "I remember in my own case that I groped around during my high school years to a very considerable extent and received but very little information as to the habits

and lives of men in various vocations, except odd glimpses of men with whom I came in contact. I finally decided on Engineering because it was at least something definite and I had a liking for mathematics and figures. However, if I had had a more practical knowledge of the lives of our most famous engineers and the qualities they possessed, which were most helpful to their success, I know that my ideals would have been higher from the start and my progress perhaps considerably faster."

"The four-year engineering course is too short to accomplish all it purposes to accomplish. My course endeavored to give me a cultural background and also to fit me equally to serve in any one of the several branches of engineering. The course should be at least five years and during the last two years a man should be allowed to specialize in his chosen line, while gaining only a general knowledge of the other branches of the profession."

"The general burden of the suggestions for the improvement of the engineering course in answer to question 14 of the questionnaire was that the course should be lengthened to 5 or 6 years and much more time be spent on non-technical and cultural courses. As might be expected in many cases these two ideas were linked as in the preceding sentence. Indeed both suggestions were made by 13.6 per cent. of those replying to the questionnaire."

"There is too much work to cover in the time given, there is not enough opportunity given for self expression and development; too much emphasis is placed on grades given for academic information and not enough on character and application. Industry pays for character and the ability to accomplish and create."

"The theoretical and practical sides of engineering should be more closely linked in the college course (instead of studying theory then later on finding out what it's all about)."

"The course offered no advancement in the appreciation of the finer and 'cultural' things of life. Sufficient training in economics and administration was lacking. There was not sufficient personal contact between the student and the faculty."

"It seems that a closer coördination of the allied subjects could be comparatively easily brought about, both in the subject matter and in teaching the course."

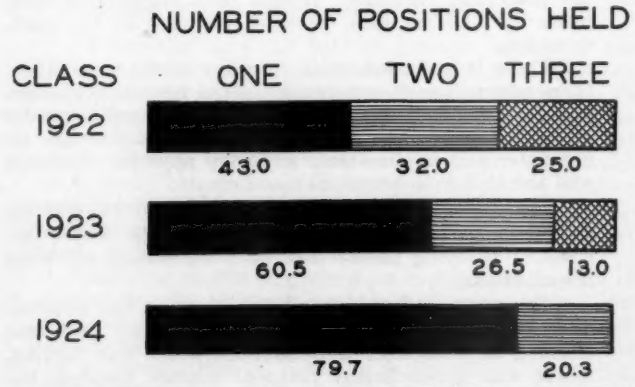
"While I do not think college is the place to get

practical experience, but rather to get a good technical foundation, I do think few of the instructors have had enough contact with industrial work to give the students a send off with the right point of view to fit in readily in industrial positions."

## A Study of Recent Graduates of Engineering.

### 1. Number of Positions Held Since Graduation.

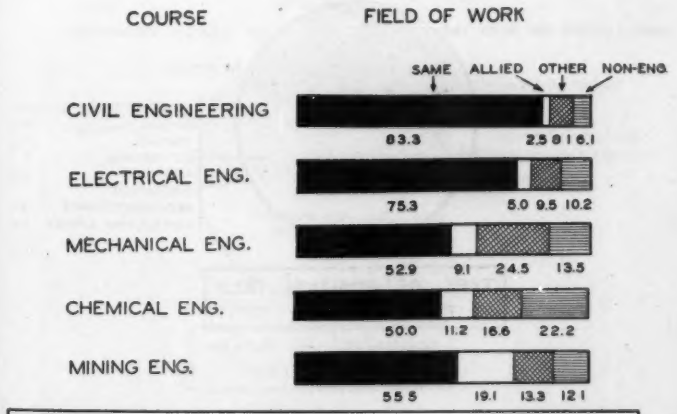
| | | Classes of | | | Totals. |
|---|---|---|---|---|---|
| | | 1922. | 1923. | 1924. | |
| One position: | Number | 542 | 835 | 988 | 2,365 |
| | Per Cent. | 43.0 | 60.5 | 79.7 | 61.0 |
| Two positions: | Number | 403 | 365 | 252 | 1,020 |
| | Per Cent. | 32.0 | 26.5 | 20.3 | 26.3 |
| Three positions: | Number | 315 | 179 | | 494 |
| | Per Cent. | 25.0 | 13.0 | | 12.7 |
| Total number reporting | | 1,260 | 1,379 | 1,240 | 3,879 |
| Not answering | | | | | 54 |




NUMBER OF POSITIONS HELD SINCE GRADUATION

2. Relationship of Fields of Work of Recent Graduates to College Course.

| Courses Graduated from. | Present Fields of Work. | | | | Totals. |
|---|---|---|---|---|---|
| | Work in Same Field. | Work in Allied Field. | Work in Unassociated Engineering Field. | Non-Engineering Field. | |
| Chemical Engineering: | | | | | |
| Number | 210 | 47 | 70 | 93 | 420 |
| Per Cent. | 50.0 | 11.2 | 16.6 | 22.2 | |
| Civil Engineering: | | | | | |
| Number | 609 | 18 | 59 | 45 | 731 |
| Per Cent. | 83.3 | 2.5 | 8.1 | 6.1 | |
| Electrical Engineering: | | | | | |
| Number | 672 | 44 | 85 | 91 | 892 |
| Per Cent. | 75.3 | 5.0 | 9.5 | 10.2 | |
| Mechanical Engineering: | | | | | |
| Number | 515 | 89 | 238 | 131 | 973 |
| Per Cent. | 52.9 | 9.1 | 24.5 | 13.5 | |
| Mining Engineering: | | | | | |
| Number | 96 | 33 | 23 | 21 | 173 |
| Per Cent. | 55.5 | 19.1 | 13.3 | 12.1 | |
| | | | | | 3,189 |

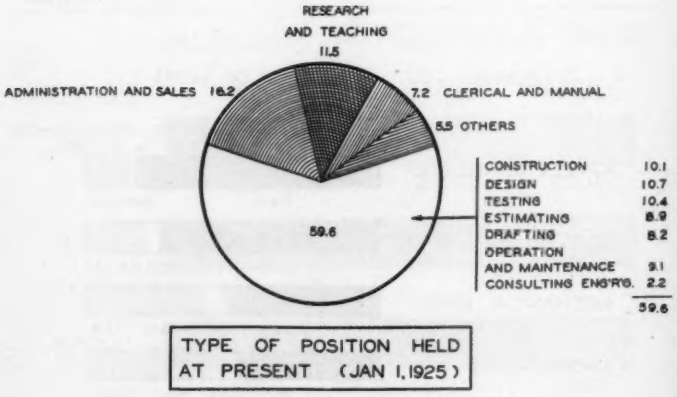



RELATIONSHIP OF FIELD OF WORK TO COLLEGE COURSE

3. Types of Positions Held by Recent Graduates as of January 1, 1925.

Secondary as well as primary aspects of positions are included.

| | Number. | Per Cent. | | Number. | Per Cent. | |
|---|---|---|---|---|---|---|
| Construction | 642 | 10.1 | Research | 482 | 7.7 | |
| Design | 681 | 10.7 | Teaching | 238 | 3.8 | |
| Testing | 662 | 10.4 | | | | 11.5 |
| Estimating | 577 | 8.9 | Administration | 605 | 9.5 | |
| Drafting | 519 | 8.2 | Sales | 428 | 6.7 | |
| Operation and Maintenance | 580 | 9.1 | | | | 16.2 |
| Consulting Engineering | 138 | 2.2 | Clerical | 338 | 5.3 | |
| | | | Manual | 121 | 1.9 | |
| | | | | | | 7.2 |
| | | | Others | 351 | 5.5 | |
| | | 59.6 | | | | 100.0 |

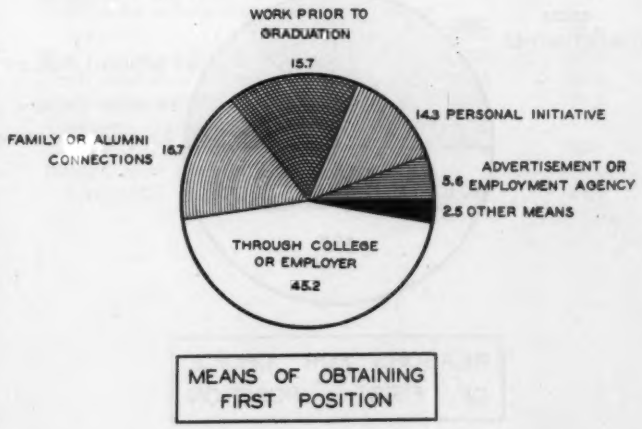



TYPE OF POSITION HELD AT PRESENT (JAN 1, 1925)

4. MEANS THROUGH WHICH RECENT GRADUATES OBTAINED FIRST POSITIONS.

A few graduates indicated more than one means.

| | Number. | Per Cent. | Total Per Cent. |
|---|---|---|---|
| Through the college or a member of the faculty | 959 | 24.7 | |
| Through solicitation by employer | 797 | 20.5 | |
| Through connection formed or work done before graduation | 608 | 15.7 | 45.2 |
| Through an advertisement | 136 | 3.5 | 15.7 |
| Through an employment agency | 81 | 2.1 | |
| Through family connection | 386 | 9.9 | 5.6 |
| Through alumni of the college | 266 | 6.8 | |
| Through personal solicitation or other endeavor of the graduate | 556 | 14.3 | 16.7 |
| By other means | 97 | 2.5 | 14.3 2.5 |
| | 3,886 | 100.0 | 100.0 |

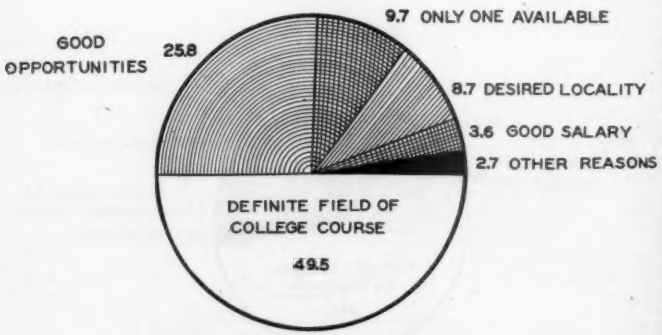



MEANS OF OBTAINING FIRST POSITION

### 5. Reasons Given by Recent Graduates for Choice of First Positions.

Some graduates gave more than one reason.

| | Number. | Per Cent. | Total Per Cent. |
|---|---|---|---|
| Position was in definite field of college course.. | 798 | 19.4 | |
| Position was in general field of college course... | 1,234 | 30.1 | |
| | | | 49.5 |
| Position seemed to offer good opportunities.... | 1,058 | 25.8 | |
| | | | 25.8 |
| Position was in desired locality..... | 358 | 8.7 | |
| Good salary..... | 149 | 3.6 | |
| | | | 12.3 |
| Only position available..... | 399 | 9.7 | 9.7 |
| Other reasons..... | 113 | 2.7 | 2.7 |
| | 4,109 | 100.0 | 100.0 |




REASONS FOR CHOICE OF FIRST POSITION

6. TYPE OF WORK DONE BY RECENT GRADUATES SINCE GRADUATION.

| | Number. | Per Cent. |
|---|---|---|
| Continuously in engineering work since graduation | 3,179 | 82.4 |
| Began in engineering work, but changed | 255 | 6.6 |
| Continuously in non-engineering work since graduation | 425 | 11.0 |
| | 3,859 | 100.0 |
| Not answering | 74 | |

7. EARNINGS SINCE GRADUATION. (FIGURES ARE MEDIANS.)

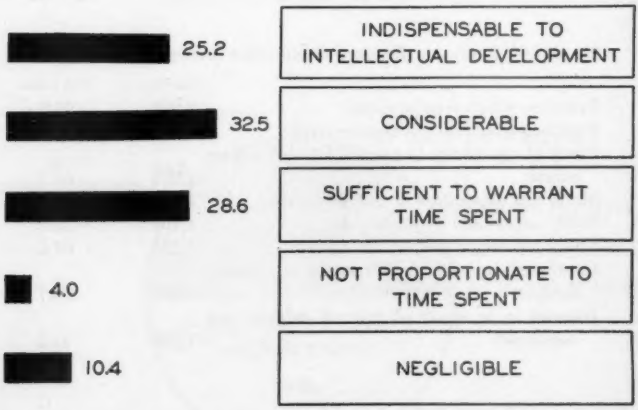
| | Per Month. | Per Year. |
|---|---|---|
| Immediately after graduation | $123 | $1,476 |
| Six months after graduation | 133 | 1,596 |
| Twelve months after graduation | 150 | 1,800 |
| Twenty-four months after graduation | 175 | 2,100 |

8. STUDY DONE BY RECENT GRADUATES SINCE GRADUATION.

| | Number. | Per Cent. |
|---|---|---|
| Positions which require study | 2,909 | 76.6 |
| Positions which do not require study | 887 | 23.4 |
| Study along definite or general lines of college course | 2,222 | 67.7 |
| Study not along lines of college course | 1,059 | 32.3 |
| Study supervised by employers | 1,105 | 32.9 |
| Study not supervised by employers | 2,255 | 67.1 |
| Continued interest in and study of cultural subject | 1,693 | 55.7 |
| Interest in or study of cultural subjects not continued | 1,346 | 44.3 |

9. Opinions of Recent Graduates as to Value of Cultural Studies Taken in College.

| | Number. | Per Cent. |
|---|---|---|
| Negligible | 356 | 10.4 |
| Not proportionate to time spent | 135 | 4.0 |
| Sufficient to warrant time spent | 977 | 28.6 |
| Considerable | 1,109 | 32.5 |
| "Indispensable to my intellectual development" | 833 | 25.2 |
| Not replying | 523 | |

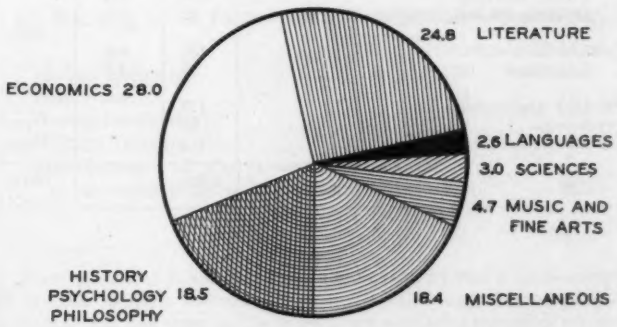



OPINIONS OF RECENT GRADUATES AS TO VALUE OF CULTURAL STUDIES TAKEN IN COLLEGE

10. TYPES OF CULTURAL INTERESTS OF RECENT GRADUATES.

All interests mentioned by the graduates under this heading are given, though some of them may have misinterpreted the word "cultural."

| | Number. | Per Cent. | Total Per Cent. |
|---|---|---|---|
| Economics and Accounting | 213 | 14.7 | |
| Business Law, Law | 38 | 2.6 | |
| Business Administration | 155 | 10.7 | |
| | | | 28.0 |
| Literature | 336 | 23.1 | |
| English, Public Speaking | 25 | 1.7 | |
| | | | 24.8 |
| History, Psychology and Philosophy | 214 | 14.7 | |
| Political Science | 19 | 1.3 | |
| Sociology | 36 | 2.5 | |
| | | | 18.5 |
| Music | 35 | 2.4 | |
| Fine Arts | 34 | 2.3 | |
| | | | 4.7 |
| Sciences | 44 | | 3.0 |
| Languages | 38 | | 2.6 |
| Miscellaneous, including Journalism, Education, and numerous other interests | 267 | | 18.4 |
| | 1,454 | | 100.0 |



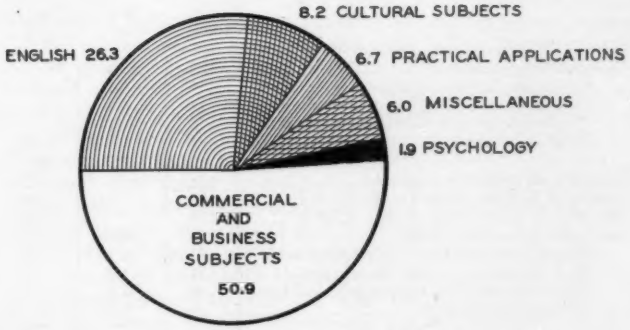

TYPES OF CULTURAL INTERESTS

11. Reactions of Recent Graduates as to Present Positions, Prospects, Etc.

| | Number. | Per Cent. |
|---|---|---|
| Satisfied with positions | 2,643 | 76.9 |
| Dissatisfied with positions | 794 | 23.1 |
| Satisfied with prospects | 2,880 | 81.0 |
| Dissatisfied with prospects | 676 | 19.0 |
| Like engineering work | 3,241 | 95.4 |
| Dislike engineering work | 155 | 4.6 |
| "Glad I studied engineering" | 3,564 | 97.7 |
| "Sorry I studied engineering" | 83 | 2.3 |

12. Opinions Given by Recent Graduates as to Important Omissions from Their College Courses.

| | Number. | Per Cent. | Total Per Cent. |
|---|---|---|---|
| Commercial and Business Subjects | 595 | 30.9 | |
| Economics, Engineering Economics | 202 | 10.5 | |
| Business Law | 59 | 3.1 | |
| Industrial Management, Labor Problems | 32 | 1.7 | |
| Salesmanship | 49 | 2.5 | |
| Accounting, Cost Keeping, Estimating | 42 | 2.2 | |
| | | | 50.9 |
| English | 334 | 17.4 | |
| Public Speaking | 150 | 7.8 | |
| Business English, Technical English | 22 | 1.1 | |
| | | | 26.3 |
| Cultural Subjects | 133 | 6.9 | |
| Languages | 25 | 1.3 | |
| | | | 8.2 |
| Practical Applications | 128 | | 6.7 |
| Psychology | 37 | | 1.9 |
| Miscellaneous | 115 | | 6.0 |
| | 1,923 | | 100.0 |




## OPINIONS GIVEN BY GRADUATES AS TO IMPORTANT OMISSIONS FROM THE COLLEGE COURSES

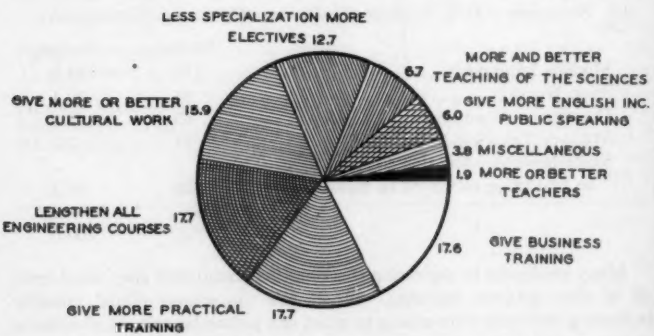
13. SUBJECTS WHICH RECENT GRADUATES CONSIDER UNESSENTIAL.

| | Number. | Per Cent. |
|---|---|---|
| Modern Languages | 170 | 21.9 |
| Shop Work | 94 | 12.1 |
| Descriptive Geometry | 55 | 7.1 |
| Military Training | 21 | 2.7 |
| Miscellaneous—All other recommendations are so scattering as not to be significant | 435 | 56.2 |
| | 775 | 100.0 |

Many graduates in answering this question stated that they considered all of their subjects essential. Others left the answer blank, possibly indicating that they were unable to select any particular subject or subjects as unessential.

14. Opinions of Recent Graduates as to Improvements in Engineering Courses.

| | Number. | Per Cent. | Total Per Cent. |
|---|---|---|---|
| Give business training | 134 | 15.4 | |
| Give more or better engineering economics | 6 | 0.7 | |
| Give more or better general economics | 11 | 1.3 | |
| Teach administrative and executive work | 1 | 0.1 | |
| Teach salesmanship | 1 | 0.1 | |
| | | | 17.6 |
| Lengthen all engineering courses | 154 | | 17.7 |
| Give more English, teach Public Speaking | 52 | | 6.0 |
| Give more cultural work, or give it better | 138 | | 15.9 |
| Give more practical training | 99 | 11.4 | |
| Use summer vacations for practical work | 21 | 2.4 | |
| Give orientation courses for Seniors | 11 | 1.3 | |
| Give students early contact with industry | 14 | 1.6 | |
| Take inspection trips | 9 | 1.0 | |
| | | | 17.7 |
| More or better teachers | 17 | | 1.9 |
| More or better teaching of the sciences | 43 | 5.0 | |
| Raise standards of work and insist upon them | 12 | 1.4 | |
| Coördinate the various courses better | 3 | 0.3 | |
| | | | 6.7 |
| Less specialization, more electives | 110 | | 12.7 |
| Miscellaneous | 33 | | 3.8 |
| | 869 | | 100.0 |




OPINIONS OF GRADUATES AS TO IMPROVEMENTS IN ENGINEERING COURSES

*Part 2: Graduates of the Classes of 1919, 1914, 1909, 1904, 1899, 1894, 1889 and 1884.*

*Earnings of Graduates.*—The number of individuals reporting is probably sufficient to give reasonably representative results for the classes as far back as 1894 only. The figures should not be used for the classes of 1884 and 1889.

*Order of Importance of the Divisions of Curricula.*—It is to be noted that the smallest score indicates the highest order of importance, and that the largest score indicates the lowest order of importance as assigned by graduates. It is also to be noted that scientific subjects and technical subjects are nearly tied for first place and that the economic and cultural subjects are also rated as of nearly equal importance.

*Opinions of Graduates as to Quality of College Training.*—The results of questions bearing on this point as given in paragraphs four, five and six constitute one of the most significant results of the project and indicate that our graduates on the whole feel that the work of the engineering colleges is good.

*Qualities Sought by Employers.*—In interpreting the results of this estimate it must be remembered that such qualities as character and leadership are equally desirable in almost any line of endeavor and that they are fundamental to other varieties of work as well as to engineering. It is obvious that engineers place more weight upon these fundamental traits than upon ability to achieve high grades in college.

*Continuation of Education.*—An interesting comparison is afforded in the results of the studies of recent graduates and the older graduates. It is to be noted that considerable progress has been made by employers of graduates in late years in providing supervised study or training periods.

1. Fields of Work of Older Graduates.

| | | Classes of | | | | | Totals. |
|---|---|---|---|---|---|---|---|
| | | 1919. | 1914. | 1904–1909. | 1894–1899. | 1884–1889. | |
| Industrial: | No..... | 158 | 276 | 363 | 164 | 24 | 985 |
| | %..... | 35.8 | 45.9 | 43.5 | 40.7 | 23.8 | 41.3 |
| Commercial: | No..... | 80 | 86 | 136 | 68 | 17 | 387 |
| | %..... | 18.2 | 14.3 | 16.3 | 16.8 | 16.8 | 16.3 |
| Financial: | No..... | 35 | 20 | 39 | 12 | 2 | 108 |
| | %..... | 7.9 | 3.3 | 4.7 | 3.0 | 2.0 | 4.5 |
| Professional: | No..... | 114 | 136 | 195 | 108 | 42 | 595 |
| | %..... | 25.9 | 22.7 | 23.3 | 26.8 | 41.6 | 25.0 |
| Governmental—Others: | No..... | 54 | 83 | 102 | 51 | 16 | 306 |
| | %..... | 12.2 | 13.8 | 12.2 | 12.7 | 15.8 | 12.9 |

## 2. Earnings of Engineering Graduates.

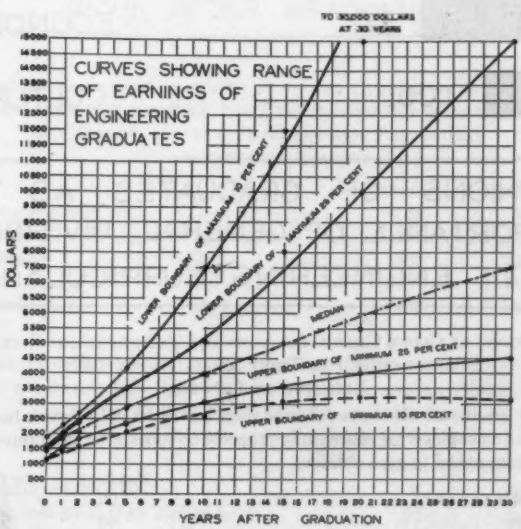
(Insufficient data to warrant determination of medians of the classes of 1889 and 1884.)

| Class of | | Years Since Graduation. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0. | 1. | 2. | 3. | 5. | 10. | 15. | 20. | 30. |
| 1924.. | Number Reporting | 1,191 | | | | | | | | |
| | Median Annual Earnings | $1,476 | | | | | | | | |
| 1923.. | Number Reporting | 1,331 | 1,218 | | | | | | | |
| | Median Annual Earnings | $1,440 | $1,800 | | | | | | | |
| 1922.. | Number Reporting | 1,149 | 1,082 | 1,023 | | | | | | |
| | Median Annual Earnings | $1,320 | $1,800 | $2,100 | | | | | | |
| 1919.. | Number Reporting | 319 | 319 | 304 | 274 | 309 | | | | |
| | Median Annual Earnings | $1,300 | $1,800 | $2,000 | $2,200 | $2,860 | | | | |
| 1914.. | Number Reporting | 496 | 475 | 458 | 436 | 444 | 498 | | | |
| | Median Annual Earnings | $ 800 | $1,000 | $1,200 | $1,600 | $2,400 | $4,000 | | | |
| 1909.. | Number Reporting | 459 | 418 | 414 | 404 | 416 | 422 | 430 | | |
| | Median Annual Earnings | $ 720 | $ 900 | $1,200 | $1,366 | $1,800 | $3,000 | $5,000 | | |
| 1904.. | Number Reporting | 243 | 223 | 221 | 212 | 202 | 226 | 216 | 238 | |
| | Median Annual Earnings | $ 720 | $ 900 | $1,200 | $1,300 | $1,530 | $2,500 | $4,000 | $5,500 | |
| 1899.. | Number Reporting | 156 | 126 | 125 | 123 | 125 | 130 | 129 | 147 | |
| | Median Annual Earnings | $ 600 | $ 800 | $1,075 | $1,380 | $1,600 | $2,700 | $4,000 | $6,000 | |
| 1894.. | Number Reporting | 119 | 97 | 96 | 92 | 109 | 102 | 103 | 100 | 116 |
| | Median Annual Earnings | $ 600 | $ 900 | $1,000 | $1,200 | $1,500 | $2,400 | $3,600 | $5,000 | $7,500 |

2a. ANALYSIS OF EARNINGS OF ENGINEERING GRADUATES AS OF JUNE 1, 1924.

| Class. | Years Since Graduation. | Number Reporting. | Annual Earnings. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum. | Limit of First 10%. | Limit of First 25%. | Median. | Limit of First 75%. | Limit of First 90%. | Maximum. | Most Frequent. |
| 1924 | 0* | 1,191 | 300 | 1,200 | 1,200 | 1,476 | 1,560 | 1,860 | 4,080 | 1,200 |
| 1923 | 1 | 1,218 | 420 | 1,404 | 1,560 | 1,800 | 1,980 | 2,280 | 5,100 | 1,800 |
| 1922 | 2 | 1,023 | 360 | 1,560 | 1,800 | 2,100 | 2,400 | 2,640 | 9,000 | 1,800 |
| 1919 | 5 | 309 | 1,500 | 2,100 | 2,400 | 2,860 | 3,500 | 4,200 | 25,000 | 3,000 |
| 1914 | 10 | 498 | 1,200 | 2,600 | 3,110 | 4,000 | 5,100 | 7,500 | 50,000 | 5,000 |
| 1909 | 15 | 430 | 1,700 | 2,700 | 3,600 | 5,000 | 8,000 | 12,000 | 49,500 | 6,000 |
| 1904 | 20 | 238 | 1,920 | 3,290 | 4,000 | 5,500 | 10,000 | 15,000 | 90,000 | 4,000 |
| 1894 | 30 | 116 | 1,980 | 3,000 | 4,500 | 7,500 | 15,000 | 30,000 | 100,000 | 6,000 |
| | Total | 5,023 | | | | | | | | |

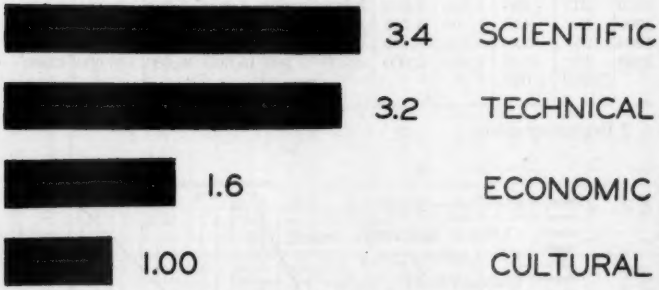
* Beginning salary.


CURVES SHOWING RANGE OF EARNINGS OF ENGINEERING GRADUATES
DOLLARS
YEARS AFTER GRADUATION
MEDIAN
UPPER BOUNDARY OF MINIMUM 25 PER CENT
UPPER BOUNDARY OF MINIMUM 10 PER CENT

3. Order of Importance Assigned by Older Graduates to the Various General Divisions of Engineering Curricula.

A score of 1 would indicate that all graduates assigned a given division first place, and a score of 4 would indicate that all graduates assigned a given division fourth place. The results were obtained by adding the various scorings and dividing by the number of individuals whose opinions are represented.

| | Weighted Score |
|---|---|
| Scientific subjects | 1.70 |
| Technical subjects | 1.80 |
| Economic subjects | 2.94 |
| Cultural subjects | 3.32 |

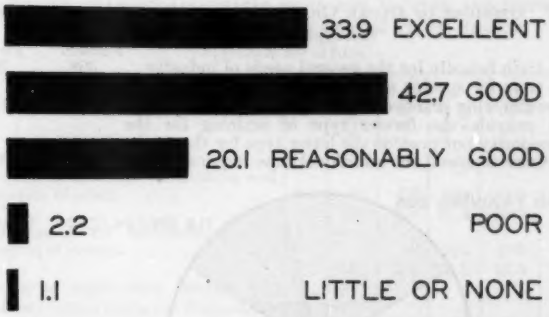



OPINIONS OF GRADUATES AS TO IMPORTANCE OF GENERAL DIVISIONS OF ENGINEERING CURRICULA

4. Opinions of Older Graduates as to the Technical and Scientific Preparation for Their Work which They Received in College.

Only graduates who have followed engineering or whose work has been such that an engineering course may properly be considered as a preparation for it, were asked to give opinions.

| | Number. | Per Cent. |
|---|---|---|
| Little or none | 20 | 1.1 |
| Poor | 40 | 2.2 |
| Reasonably good | 360 | 20.1 |
| Good | 763 | 42.7 |
| Excellent | 606 | 33.9 |




OPINIONS OF GRADUATES AS TO TECHNICAL AND SCIENTIFIC PREPARATION IN COLLEGE FOR WORK AFTER GRADUATION

5. Opinions of Older Graduates as to the Quality or Sufficiency, of Relationship between the Engineering Subjects Studied in College and the Problems and Procedures of Engineering Practice.

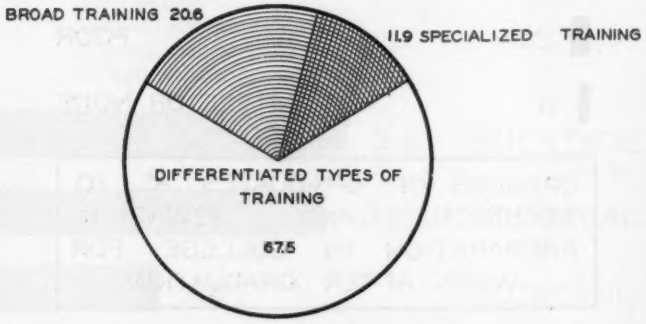
| | Number. | Per Cent. |
|---|---|---|
| Conspicuously poor | 15 | 0.8 |
| Poor, not what it should have been | 101 | 5.6 |
| Passable | 406 | 22.3 |
| Good | 1,016 | 55.9 |
| Excellent | 280 | 15.4 |

6. Opinions of Older Graduates as to the Standards of Work Done and of Graduates Produced by the Engineering Colleges as Fixed by the Requirements of the Field of Engineering Practice.

| | Number. | Per Cent. |
|---|---|---|
| Conspicuously poor | 6 | 0.3 |
| Poor, not what they should be | 92 | 5.2 |
| Passable | 495 | 27.9 |
| Good | 1,001 | 56.4 |
| Excellent | 182 | 10.2 |

7. Opinions of Older Graduates as to the Objectives of Engineering Courses.

| | Number. | Per Cent. |
|---|---|---|
| To train broadly for the general needs of industry | 398 | 20.6 |
| To train for specific needs of specialized divisions of engineering practice | 229 | 11.9 |
| To provide the former type of training for the majority but provide the latter type for those who desire to spend the additional time required | 1,304 | 67.5 |




OPINIONS OF GRADUATES AS TO OBJECTIVES IN ENGINEERING COURSES

8. Qualities Sought by Engineers in Other Engineers whom They Employ.

A score of 1 would indicate that all of those who replied had assigned a given quality first place, and a score of 5 would indicate that all of those who replied had assigned a given quality fifth place. The scores were obtained by adding all of the scores assigned to a given quality and dividing by the number of individuals who gave opinions.

| Average Score, or Order of Importance. | Quality. | | Relative Weight. | | |
|---|---|---|---|---|---|
| | | | Little. | Moderate. | Great. |
| 1.74 | Character | No. | 18 | 195 | 806 |
| | | % | 1.8 | 19.1 | 79.1 |
| 2.06 | Leadership | No. | 40 | 208 | 782 |
| | | % | 3.9 | 20.2 | 75.9 |
| 3.31 | Physical Qualities | No. | 83 | 690 | 229 |
| | | % | 8.3 | 68.8 | 22.9 |
| 3.27 | Training in a particular course or specialty | No. | 228 | 513 | 259 |
| | | % | 22.8 | 51.3 | 25.9 |
| 4.02 | Scholastic Record | No. | 372 | 529 | 78 |
| | | % | 37.9 | 54.1 | 8.0 |

9. OPINIONS OF OLDER GRADUATES AS TO THE MANNER AND EXTENT TO WHICH THEIR COLLEGE EXPERIENCES HAVE BEEN VALUABLE TO THEM.

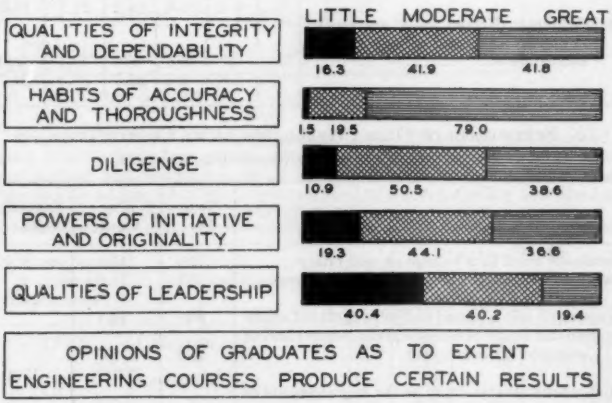
| | | None. | Little. | Moderate. | Great. | Very Great. |
|---|---|---|---|---|---|---|
| Discipline in methods of thinking and habits of work | No. | 16 | 77 | 499 | 793 | 662 |
| | % | 0.8 | 3.8 | 24.4 | 38.7 | 32.3 |
| Knowledge of the fundamental principles of science | No. | 3 | 46 | 515 | 884 | 616 |
| | % | 0.1 | 2.2 | 25.0 | 42.8 | 29.9 |
| Training in engineering courses and direct preparation for engineering work | No. | 39 | 226 | 861 | 630 | 219 |
| | % | 2.2 | 11.4 | 43.6 | 31.9 | 11.1 |
| Training in craftsmanship | No. | 65 | 397 | 783 | 461 | 170 |
| | % | 3.5 | 21.1 | 41.7 | 24.6 | 9.1 |
| Acquirement of the basis of a liberal education | No. | 56 | 334 | 732 | 569 | 247 |
| | % | 2.9 | 17.2 | 37.8 | 29.3 | 12.8 |
| Inspiration and guidance derived from members of the faculty | No. | 122 | 411 | 651 | 504 | 274 |
| | % | 6.2 | 20.9 | 33.2 | 25.7 | 14.0 |
| Associations and friendships formed with fellow students | No. | 85 | 366 | 664 | 530 | 294 |
| | % | 4.4 | 18.9 | 34.2 | 27.3 | 15.2 |
| Development derived in a not easily definable way from college life and atmosphere | No. | 50 | 175 | 536 | 661 | 393 |
| | % | 2.8 | 9.6 | 29.5 | 36.4 | 21.7 |

10. STATEMENTS OF OLDER GRADUATES AS TO CONTINUATION OF TECHNICAL EDUCATION SINCE GRADUATION.

| | Number. | Per Cent. | Total Per Cent. |
|---|---|---|---|
| Graduate work in a college or university | 320 | 10.1 | |
| Extension, correspondence or similar courses | 367 | 11.6 | 21.7 |
| Systematic self-planned and self-regulated study | 445 | 14.1 | |
| Systematic study of courses given, supervised or required by employers | 180 | 5.7 | 19.8 |
| Such unsystematic study as the requirements of work have demanded | 1,464 | 46.3 | 46.3 |
| Others | 146 | 4.6 | 4.6 |
| No study along technical lines | 242 | 7.6 | 7.6 |
| | 3,164 | 100.0 | 100.0 |

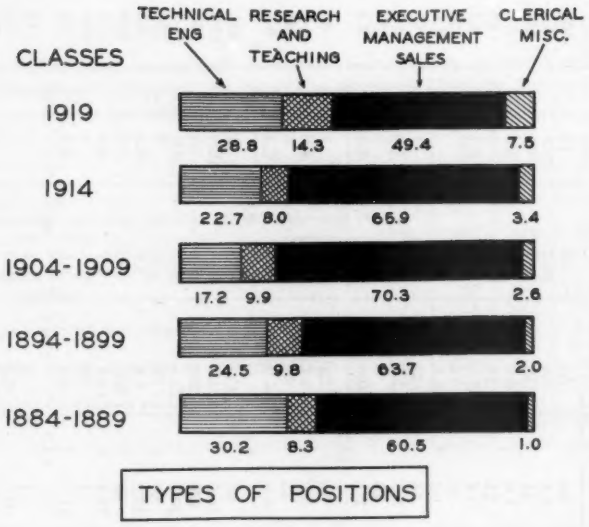
11. EXPRESSIONS OF OPINION OF OLDER GRADUATES AS TO THE EXTENT ENGINEERING COURSES ARE LIKELY TO PRODUCE CERTAIN RESULTS.

| | | Little. | Moderate. | Great. |
|---|---|---|---|---|
| Promote or develop qualities of integrity and dependability | No. | 263 | 679 | 677 |
| | % | 16.3 | 41.9 | 41.8 |
| Promote or develop habits of accuracy and thoroughness | No. | 25 | 330 | 1,335 |
| | % | 1.5 | 19.5 | 79.0 |
| Promote or develop diligence | No. | 173 | 801 | 613 |
| | % | 10.9 | 50.5 | 38.6 |
| Develop powers of initiative and originality | No. | 312 | 715 | 592 |
| | % | 19.3 | 44.1 | 36.6 |
| Develop qualities of leadership | No. | 648 | 644 | 310 |
| | % | 40.4 | 40.2 | 19.4 |



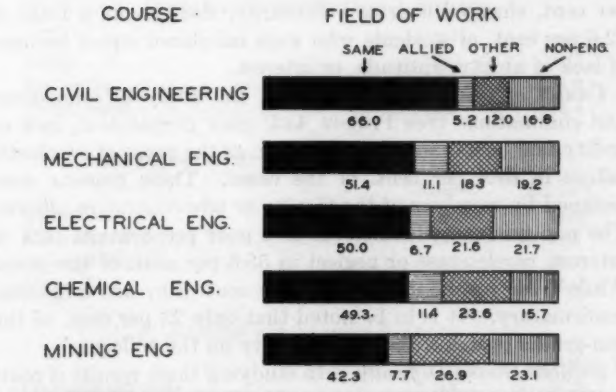
12. Types of Positions of Older Graduates.

| | | Classes. | | | | | | | | | | Totals. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1919. | | 1914. | | 1904 and 1909. | | 1894 and 1899. | | 1884 and 1889. | | |
| Consulting Engr. | No. | 12 | | 34 | | 55 | | 44 | | 18 | | 163 |
| | % | 2.7 | | 5.4 | | 6.5 | | 10.2 | | 18.8 | | 6.7 |
| Design | No. | 37 | | 44 | | 47 | | 24 | | 5 | | 157 |
| | % | 8.4 | | 7.0 | | 5.6 | | 5.6 | | 5.2 | | 6.4 |
| Estimating | No. | 20 | | 21 | | 11 | | 5 | | 3 | | 60 |
| | % | 4.5 | | 3.4 | | 1.3 | | 1.2 | | 3.1 | | 2.5 |
| Drafting | No. | 10 | | 6 | | 4 | | 5 | | | | 25 |
| | % | 2.3 | | 1.0 | | 0.5 | | 1.2 | | | | 1.0 |
| Operation & Main. | No. | 20 | | 24 | | 23 | | 22 | | 1 | | 90 |
| | % | 4.5 | | 3.8 | | 2.7 | | 5.1 | | 1.0 | | 3.7 |
| Testing & Insp'n | No. | 28 | | 13 | | 5 | | 5 | | 2 | | 53 |
| | % | 6.4 | | 2.1 | | 0.6 | | 1.2 | | 2.1 | | 2.2 |
| | | | 28.8 | | 22.7 | | 17.2 | | 24.5 | | 30.2 | |
| Research | No. | 30 | | 26 | | 23 | | 18 | | 1 | | 98 |
| | % | 6.8 | | 4.2 | | 2.7 | | 4.2 | | 1.0 | | 4.0 |
| Teaching | No. | 33 | | 23 | | 61 | | 24 | | 7 | | 148 |
| | % | 7.5 | | 3.8 | | 7.2 | | 5.6 | | 7.3 | | 6.1 |
| | | | 14.3 | | 8.0 | | 9.9 | | 9.8 | | 8.3 | |
| Owner or Prop'r | No. | 24 | | 66 | | 121 | | 81 | | 19 | | 311 |
| | % | 5.5 | | 10.5 | | 14.4 | | 18.8 | | 19.8 | | 12.8 |
| Executive & Admin. | No. | 54 | | 130 | | 228 | | 113 | | 23 | | 548 |
| | % | 12.3 | | 20.7 | | 27.1 | | 26.3 | | 24.0 | | 22.5 |
| Management | No. | 25 | | 64 | | 79 | | 32 | | 7 | | 207 |
| | % | 5.7 | | 10.2 | | 9.4 | | 7.4 | | 7.3 | | 8.5 |
| Superintendence | No. | 53 | | 83 | | 105 | | 33 | | 5 | | 279 |
| | % | 12.0 | | 13.2 | | 12.5 | | 7.7 | | 5.2 | | 11.5 |
| Sales | No. | 61 | | 71 | | 58 | | 15 | | 4 | | 209 |
| | % | 13.9 | | 11.3 | | 6.9 | | 3.5 | | 4.2 | | 8.6 |
| | | | 49.4 | | 65.9 | | 70.3 | | 63.7 | | 60.5 | |
| Clerical | No. | 6 | | 4 | | 2 | | 1 | | | | 13 |
| | % | 1.4 | | 0.7 | | 0.2 | | 0.2 | | | | 0.5 |
| Miscellaneous | No. | 26 | | 17 | | 20 | | 8 | | 1 | | 72 |
| | % | 6.1 | | 2.7 | | 2.4 | | 1.8 | | 1.0 | | 3.0 |
| | | | 7.5 | | 3.4 | | 2.6 | | 2.0 | | 1.0 | |
| Total Numbers | | 439 | 100.0 | 626 | 100.0 | 842 | 100.0 | 430 | 100.0 | 96 | 100.0 | 2,433 |




13. Relationship between Fields of Work of Older Graduates and Undergraduate Courses Pursued.

| Courses Graduated from. | | Present Fields of Work. | | | | Totals. |
|---|---|---|---|---|---|---|
| | | Work in Same Field. | Work in Closely Associated Field. | Work in Unassociated Field. | Non-Engineering Field. | |
| Chemical Engineering..... | No. | 69 | 16 | 33 | 22 | 140 |
| | % | 49.3 | 11.4 | 23.6 | 15.7 | |
| Civil Engineering..... | No. | 494 | 39 | 90 | 126 | 749 |
| | % | 66.0 | 5.2 | 12.0 | 16.8 | |
| Electrical Engineering..... | No. | 309 | 41 | 133 | 134 | 617 |
| | % | 50.0 | 6.7 | 21.6 | 21.7 | |
| Mechanical Engineering... | No. | 292 | 63 | 104 | 109 | 568 |
| | % | 51.4 | 11.1 | 18.3 | 19.2 | |
| Mining Engineering..... | No. | 44 | 8 | 28 | 24 | 104 |
| | % | 42.3 | 7.7 | 26.9 | 23.1 | |
| Total Numbers..... | | 1,208 | 167 | 388 | 415 | 2,178 |
| | | 55.5 | 7.7 | 17.8 | 19.0 | |




RELATIONSHIP OF FIELD OF WORK TO COLLEGE COURSE

*Part 3: Former Students—Non-Graduates.*

With reference to all of the results in this division it should be noted that the number of replies is insufficient to warrant any but the most general inferences.

*Time of Leaving College.*—The figures indicate clearly that the results are not representative since there is an insufficient representation of students who left college during the freshman year.

*Health, College Activities, etc.*—It is apparent that health, participation in college activities and self-support were not more important factors among those who left college than among students who remained.

*Reasons for Leaving College.*—Financial difficulty is given in a much larger percentage of cases than in the results of the study of admissions and eliminations (See Project Aa2). The reason for this may be that the results do not represent the entire group of non-graduates or the college authorities may not have been informed in all cases of financial difficulty. It is to be noted that a total of 32.6 per cent. of the non-graduates stated their reasons for leaving college were either scholastic failure or lack of interest in the work and that 10

per cent. changed courses voluntarily, thus giving a total of 42.6 per cent. of students who were misplaced either because of lack of ability, aptitude, or interest.

*Causes of Scholastic Failure.*—In the study of admissions and eliminations (See Project Aa2) poor preparation, lack of ability and lack of interest was given as the cause of scholastic failure in 69.4 per cent. of the cases. These reasons were assigned by members of the faculty or administrative officers. The non-graduates themselves give poor preparation, lack of interest, carelessness or neglect in 55.6 per cent. of the cases. While these results differ by 14 per cent. they are in general confirmatory. It is to be noted that only 23 per cent. of the non-graduates place the responsibility on the colleges.

*Subjects Giving Difficulty.*—In studying these results it must be remembered that the average period spent in college by the non-graduates canvassed is 1.8 years and that during this period the important subjects given are mathematics and the fundamental sciences. It is, therefore, to be expected that there would be few replies indicating difficulty in the engineering subjects.

*Defects in Engineering Course.*—It is significant to note that more emphasis is placed by the non-graduates upon the lack of individual attention than upon any other one thing.

1 TIME AT WHICH STUDENTS LEFT COLLEGE.

| | Number. | Per Cent. |
|---|---|---|
| During first semester of Freshman year | 43 | 6.0 |
| During second semester of Freshman year | 119 | 16.5 |
| | 162 | 22.5 |
| During Sophomore year | 266 | 36.8 |
| During Junior year | 190 | 26.3 |
| During Senior year | 104 | 14.4 |
| Totals | 722 | 100.0 |

Average length of residence 3.7 semesters—1.8 years.

2. HEALTH DURING COLLEGE CAREER.

| | Number. | Per Cent. |
|---|---|---|
| Good | 538 | 78.4 |
| Medium | 112 | 16.3 |
| Poor | 36 | 5.3 |

3. Participation in College Activities.

| | Number. | Per Cent. |
|---|---|---|
| Little | 252 | 33.7 |
| Moderate | 350 | 46.9 |
| Considerable | 145 | 19.4 |

4. Self-support during College Career.

| | Number. | Per Cent. |
|---|---|---|
| Complete | 161 | 24.3 |
| More than half | 127 | 19.2 |
| To small degree | 136 | 20.5 |
| None | 239 | 36.0 |

5. Reasons for Leaving College.

| | Number. | Per Cent. |
|---|---|---|
| Financial difficulty | 219 | 24.3 |
| Scholastic failure | 205 | 22.7 |
| Lack of interest in engineering | 89 | 9.9 |
| Voluntary change of course | 90 | 10.0 |
| War service | 106 | 11.7 |
| Health | 72 | 8.0 |
| Change in status of family | 58 | 6.4 |
| Other reasons | 63 | 7.0 |

6. Causes of Scholastic Difficulty.

| | Number. | Per Cent. | Total Per Cent. |
|---|---|---|---|
| Poor preparation | 98 | 18.2 | |
| Carelessness or neglect on part of student | 115 | 21.4 | |
| Lack of interest or aptitude for engineering | 86 | 16.0 | |
| | | | 55.6 |
| Poor arrangement of course | 71 | 13.2 | |
| Poor presentation of subjects | 54 | 10.0 | |
| | | | 23.2 |
| Self-support | 39 | 7.2 | |
| Time spent in commuting | 15 | 2.8 | |
| | | | 10.0 |
| Social diversions | 23 | 4.3 | |
| Athletics | 10 | 1.9 | |
| Other college activities | 5 | 1.3 | |
| | | | 7.5 |
| Other reasons | 20 | | 3.7 |
| | | | 100.0 |

7. SUBJECTS IN WHICH STUDENTS HAD MOST DIFFICULTY.

| | Number. | Per Cent. |
|---|---|---|
| Mathematics | 204 | 21.4 |
| Chemistry | 155 | 16.3 |
| Descriptive Geometry and Drawing | 116 | 12.2 |
| Modern languages | 120 | 12.6 |
| Physics | 101 | 10.6 |
| Mechanics | 88 | 9.3 |
| English | 74 | 7.8 |
| Laboratory Courses | 39 | 4.1 |
| Engineering Subjects | 30 | 3.2 |
| Shop Courses | 20 | 2.1 |
| Others | 4 | 0.4 |
| | | 100.0 |

8. OPINIONS OF FORMER STUDENTS AS TO PRINCIPAL DEFECTS IN ENGINEERING COURSES.

| | Number. | Per Cent. |
|---|---|---|
| Too little attention to the problems of the individual student | 218 | 21.4 |
| Failure to correlate study with practice | 135 | 13.3 |
| Examinations given too much weight | 109 | 10.7 |
| Poor teaching | 105 | 10.3 |
| Too much "theory" | 92 | 8.9 |
| Too much history, languages, etc. | 87 | 8.6 |
| Too little history, languages, etc. | 73 | 7.2 |
| Too much work required | 64 | 6.3 |
| Too many courses given at the same time | 49 | 4.8 |
| Too much shop, drafting, report writing, etc. | 46 | 4.5 |
| Others | 41 | 4.0 |
| | | 100.0 |

## SUMMARY AND REPORT, PROJECT Ab1.

## A STUDY OF TEACHING PERSONNEL OF THE COLLEGES OF ENGINEERING.

Data upon which the following report and summaries are based were obtained through the coöperation of committees of the faculties in institutions which participated in the project, through individual teachers who supplied information relative to earnings, and through the Deans or other administrative officers of the institutions.

The number of institutions and of individuals supplying information in the three divisions of the project are as follows:

(1) Economic Status of Engineering Teachers—2,279 teachers in 75 institutions, 80 per cent. of the individuals canvassed supplied the desired information.

(2) Policies Pursued by the Colleges in Connection with Recruitment and Development of Teaching Staffs—116 institutions.

(3) Sources from Which Teachers are Drawn and Positions Which Teachers Fill when They Leave the Colleges—71 institutions.

The institutions included represent all types which offer engineering courses and all parts of the United States and Canada and it is believed that the data represents conditions throughout the two countries accurately.

The project was carried out under the sponsorship of the Committee on Teaching Personnel:

C. H. Warren, Chairman,
W. H. Kenerson, Secretary,
J. H. Cissel,
H. E. T. Haultain,
C. S. Howe,
M. S. Ketchum,
P. F. Walker.

The report of the committee is given in the following pages. A condensed summary of the statistical results is also given. This summary is very much condensed from the original tabulations which may be consulted at the Office of the Director of Investigation.

H. P. HAMMOND,
*Associate Director of Investigation.*

## PRELIMINARY REPORT OF THE COMMITTEE ON TEACHING PERSONNEL.

THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.

*Gentlemen:* Your special committee appointed to coöperate with the Office of the Director of Investigation in the study of teaching personnel of the colleges of engineering presents herewith a first report. We submit the data collected, summarized in carefully prepared tables and will, with your permission, make comments thereon and point out such conclusions as seem justified at this time. The principal matters of importance in this report are the summary tables. The comments are intended only to focus attention on certain significant points.

### *Part I: Participation of Teachers in Engineering Practice, Development of Teaching Staffs, Etc.*

*Professional Practice by Teachers during the Academic Year.*—The data indicate that teachers are permitted to engage in practice during term time in 96 per cent. of the 116 institutions returning information. Only five institutions among the state universities and state land grant colleges do not permit it. The practice is encouraged in 68.5 per cent., tolerated in 27.0 per cent., and discouraged in only 2.7 per cent. of those institutions which permit it. (Two institutions (1.8 per cent.) did not answer this question.) So few institutions impose any restrictions on such work, except that it shall not interfere with the teacher's regular work, that this appears to be the prevailing practice. The matter is in general left to the good sense of the individual, although in the case of the younger

men there is some oversight by those in authority, some 14 institutions exercising some definite plan of supervision. The type of work which may be done does not seem to have come under close supervision. Fifteen out of the 111 institutions which permit outside work during term time definitely specify that the work must be such as to advance professional standing.

The fact that there are so few restrictions; that so many encourage outside work by teachers during term time; that there are definite arrangements in many institutions for the purpose of assisting the younger teachers to obtain such work; and that in general the individual members of the staffs are trusted to use their own discretion as to how much and what sort of work they shall do, seems to indicate that the practice is looked upon as a healthy one, and that it has not been abused. The evidence furnished by the tables showing data on supplementary incomes of teachers points in the same direction. The incomes from this source are moderate on the average and unless the rate of pay is absurdly small, the total bulk of outside work can hardly be regarded as sufficient to present any really serious problem—this remark applying, of course, to the situation as a whole. The practice seems to afford teachers a desirable opportunity to keep in contact with current practice. This is an advantage in their teaching work, broadens and enlivens their interests, and furnishes additional income which doubtless tends to make them contented with their positions. Much of the outside work leads to results of general technical value and redounds to the credit of the institution and to those who participate in it.

*Arrangements for Use of Laboratories by Teachers for Outside Work.*—This subject is related closely to the previous one. Only three of the institutions which permit outside practice by members of the teaching staff do not permit the use of college laboratories in connection with such work. In 44 per cent. of the institutions which do permit the laboratories to be used, materials and certain other costs are paid for by those who use the laboratories. In 40 per cent. of the institutions a fee is charged in addition for the use of the laboratory. There are also certain other special regulations. It is to be

noted that in only one institution, as far as known, is any definite attempt made to fix a charge for use of the laboratories for overhead computed as a certain percentage of labor costs. Why should the institution not be reimbursed, not only for materials and labor used but for overhead? The latter is usually unknown but probably cannot be less than 50 per cent. of labor cost. Probably the volume of work has not been great enough to be a serious item and has simply been allowed to go into the general expense account of the institution.

*Use of Name of Institution in Connection with Outside Work.*—Approximately 80 per cent. of the colleges look upon the individual doing the work as solely responsible for results, and institutional responsibility is disclaimed or expressly denied. Ten per cent. state that the professor may state his identity with the institution, though this probably does not imply any responsibility of the institution for the results of the work. The institutions having experiment stations send out official reports confined to data but give no opinion or guarantee as to its value.

In general it appears that the engineering colleges avoid any official connection with industrial work, but act rather as true public service institutions placing, so far as practicable, their facilities—including teachers—at the disposal of their public, allowing the staff to render service on their own responsibility to the mutual benefit of all concerned.

*Assistance to Younger Teachers in Broadening Their Experience.*—Of the 116 institutions reporting, 79 per cent. give such assistance while 18 per cent. do not. Apparently there is a strong tendency to assist younger teachers to secure vacation employment. One institution, the New Mexico College of Agriculture and Mechanic Arts, not only makes an effort to place its staff in vacation work, but actually provides financial assistance to members of its faculty for pursuit of courses of study, etc. A few others make similar arrangements through grants from endowment funds. This is excellent for the younger men.

*Sabbatical Leave.*—Sixty-five per cent. of the institutions have no policies as to sabbatical leaves for teachers of engi-

neering. Thirty-two per cent. of the institutions have policies of varying types. The frequency of permitted leaves varies from one half year in three to one year in eight; the term sabbatical evidently not being confined to its strictly derivative sense. Salary during leave is usually adjusted on the basis of half year with full pay or full year on half pay.

It is rather significant to note that only 77 leaves of absence of all kinds have been taken by teachers of engineering in the past five years. This number is in 116 institutions having a total faculty of perhaps three thousand members. The rate is about 15 individual leaves per year or about 0.5 per cent. of the total number of teachers. It would be interesting to know how these figures compare with those for college teachers in other lines. It seems possible that teachers of engineering avail themselves of sabbatical leave to a lesser extent than other teachers. If there were more demand for such leaves it is probable that the practice would be more general among the colleges, and it is probably the fact that engineering teachers supply the want of leaves of absence through the practical engineering work which they carry on during the college year and in vacations.

*Instruction in the Art of Teaching.*—Your committee were led to ask for data on this subject because they were conscious that there is constant criticism from certain sources that the art of teaching is neglected in the engineering colleges and that men are hired to teach rather because of their knowledge of the subject than their ability to impart it to others. The returns indicate that 85 per cent. of the schools give no systematic instruction in the art; 5 per cent. answer in the affirmative for all departments; 5 per cent. state that such instruction is given in some departments; and about 5 per cent. did not reply to the question. In connection with this matter it is to be noted that in 21 per cent. of the institutions it is customary for the older teachers to visit the classrooms of younger teachers, and that in 33 per cent. it is customary for the younger teachers to observe the methods of older teachers. About three fourths of the faculties seem to feel that such instruction is or could be made of substantial value;

about one fifth feel otherwise. The general impression is that there is apparently a rather mild feeling that some sort of instruction might be made of value, but there is much doubt as to whether or not anything worth while can be done, or, if it could be done, who should do it and how. It seems to be a rather general impression in the engineering colleges that good teachers are born, not made, and that the poor teachers can be eliminated quite easily. It is evident from the replies that departmental conferences on methods of presenting particular subjects are generally the practice, and although the amount of this varies widely it really constitutes in its entirety a method of great instructional value.

We venture to comment on the fact that although not specifically asked for in the questionnaire, all mention of instruction in the art of speaking and behavior in the classroom was conspicuously absent in all replies. We venture to express the opinion that young teachers could be greatly helped by some instruction in the art of speech, and in the matter of their actions and behavior before classes. If a teacher is obviously master of his subject, has his material well arranged, and possesses a strong and pleasing personality, he may get by even though he has serious faults of speech or manner; but these nearly always lessen his effectiveness, sometimes very seriously. Such faults may become serious drawbacks to success and they might often be easily corrected by a little tactful criticism and advice offered when the teacher is young.

The comments from various schools on the matter of instruction in the art of teaching which are given in the summary of data are worth reading. They give an excellent cross-section of opinion and practice on this subject.

*Use of Men Regularly Employed in Industry as Auxiliary Teachers, and Instruction Given to Employees of Industries by College Teachers.*—As a part of the investigation it was decided to learn to what extent the engineering colleges make use of men regularly employed in industry as part-time teachers in the schools, and also to learn to what extent the colleges coöperate in educational work done by the industries for the benefit of their employees. It is learned that about one fourth

of the colleges use men from the industries as part-time teachers, and that an equal proportion (though not necessarily the same institutions) supply teachers from the staffs to assist in carrying on educational work for employees. The general opinion is that both of these practices are valuable to a certain extent. It is noted by some institutions that care must be exercised in correlating the work of the man from the industry with the work of the regular staff, and in keeping him from going over the head of his class. The outside man may often be inspiring and may present new points of view to the class, but we infer that instruction of this sort is to be regarded as an auxiliary to, rather than as a substitute for, regular staff instruction.

*Part II: Study of Salaries and Supplementary Earnings of Engineering Teachers.*

The results of this study constitute a very successful attempt to picture the financial status of a particular class of individuals. About 2,850 questionnaire cards were distributed to members of the staffs of 75 representative institutions throughout the United States and Canada. Eighty per cent. of those canvassed, or a total of 2,279 individuals submitted responses which are compiled in the tables. This does not include about 70 cards improperly or incompletely filled out or a number of cards received after the tables and charts were prepared. It is believed that the figures given in the summary tables are quite reliable and furnish an entirely trustworthy cross-section of the financial situation of the teachers of engineering as that situation exists to-day. It may be that a few very large supplementary incomes have not been reported, but since results are reported as medians it is not likely that these few cases would materially affect the results. In this connection it may be noted that there are a considerable number of incomes in excess of $10,000 per year included in the results.

The figures for maximum and minimum salaries call for little comment. It is possible that the exceptionally low salaries of some individuals of long periods of service may

represent shop instructors, or possibly even teachers on part-time, though it was not intended to include the latter.

Of the 2,279 individuals reporting, 1,785 state that they have supplementary incomes, the percentages for the various ages ranging from 58.5 to 100, with an average for the entire group of 78.5. There is a gradual increase in this percentage, with minor fluctuations. The median supplementary incomes show a gradual increase throughout the period, reaching a maximum median figure of $2,000 per year for those who reported supplementary incomes. There is a noticeable but unexplained sudden increase in the supplementary incomes at the twentieth year after graduation. Preceding this year the incomes from supplementary sources range from $600 to $880 per year. At the twentieth year there is a sudden increase to $1,200 per year. From this point on the supplementary incomes in four figures continue. The supplementary incomes rather rarely reach one third of the median or most frequent salaries. On the whole the supplementary incomes are modest in amount and controvert the statement so often heard that engineering teachers earn large sums from engineering practice.

The data of this and other studies (See Summaries of Project Aa4—A Study of Engineering Graduates) afford a basis of comparison with the earnings of engineering graduates in practice. Table 4 shows the ratio of salaries of teachers of engineering to those of graduates. At the start the teachers salary and total earned income exceed the earnings of graduates by a small amount. At the end of one year their total incomes are practically equal. After one year the teachers earn steadily less than graduates in practice, until at the thirtieth year after graduation the total earnings of teachers are but 74 per cent. of those of graduates in practice. When academic salaries—either median or most frequent—are made the basis of comparison, the status of the teacher as to earnings is, of course, still less favorable. The young teacher beginning his career must, it appears, look forward in general to a smaller income than if he went into practice—assuming that his earning capacity in industry is proportionately as great

as it is in teaching. There are two comments which might be made on this situation: one, the oft-stated compensations pertaining to the career of a teacher (though some question whether these are more imaginary than real), and the second, the difficulty of recruiting able teaching staffs with the handicap of smaller compensations than can be earned in practice.

Table 3 presents a summary of salaries arranged according to teaching rank. This table includes 69 of the 75 institutions included in Table 1. The institutions have been carefully chosen and probably give a reliable cross-section of salary levels throughout the United States and Canada. The small median and most frequent salaries of Deans and Professors are striking. If we compare these salaries with those on the basis of years since graduation, using the most frequent salaries as an index, we may conclude that teachers reach the grade of Assistant Professor in about eight years, the grade of Associate Professor in about 15 to 20 years, and that of Professor in from 20 to 25 years.

*Sources from Which Engineering Teachers are Obtained.*—The figures summarized in Table 5 show that a majority (67.1 per cent.) of teachers of all ranks are obtained through promotion from graduating classes and from the teaching ranks, so that the body of our staffs is built up from this source. There is a substantial interchange between schools, ranging from about 11.4 per cent. in the case of Assistants to about 37.5 per cent. for Deans, the average being about one fifth for all grades. There is also a notable proportion of teachers derived from engineering practice, ranging from about one fifth for the professorial ranks to about one third for Instructors. We believe these figures show a satisfactory state of affairs; that they relieve us of the accusation of inbreeding within individual institutions; and that they give assurance of a substantial and healthy leaven from the ranks of the engineering profession.

The percentages of Instructors and Assistants secured from other institutions deserve comment. This number is due in part doubtless to a policy of securing men with varied training and experience, but it is also probably connected with a

tendency on the part of the young men themselves to gain experience, or to pursue further study at an institution other than the one from which they graduated. Whatever the cause, it is a healthy situation, pointing as it does to a large circulation of young men among the schools.

The return of young men from industry is also probably on the whole a satisfactory state of affairs. There are probably many of them who desire to get a more thorough grasp on theory and plan to do graduate study along with their teaching. They should come back from industrial work with a broadened viewpoint and a clear idea as to what is important in education. We should not overlook the fact, however, that some of these young men come back because they find industrial work not to their taste, or the pace faster than they can maintain. An uncertain proportion of them are perhaps of doubtful value.

It is significant to note from Table 5 that the number of new men added in a period of five years to the staffs in ranks below that of Assistant Professor exceeds the number of men holding such positions at present. It is evident that there is a considerable shifting of teaching personnel in the lower ranks.

*Losses of Teachers to Practice and Industry.*—Commenting on the losses during the five-year period covered by Table 6 (1920 to 1924 inclusive) it appears that the annual turn-over for all grades of teachers and for all changes of positions is about 10 per cent. The actual annual loss of teachers by the institutions is about 6.75 per cent. In the grades of Instructor and Assistant the percentage of losses is much larger than in the professorial grades—11.5 per cent. as compared with 3.35 per cent. The total percentages of teachers who change their positions per year to go to other institutions or to leave teaching are as follows: to take another teaching position—3.37 per cent.; to enter practice—4.46 per cent.; to enter business—1.09 per cent.; to enter other activities—1.13 per cent. a total of 10.1 per cent., as above mentioned. The total loss of teachers above the rank of Instructor, expressed in per cent. per year, is about three and one third per cent. of the total number of teachers of those ranks. These figures indicate that the teaching staffs of the engineering colleges,

particularly in the higher ranks, have reached a reasonably stable condition. The total turn-over per year, 10 per cent., includes promotions within institutions and interchange between institutions. This figure is certainly not unduly large. The losses to practice, industry and business are small, particularly in the higher ranks. The figures do not bear out the commonly expressed belief that the industries are depriving the colleges of experienced and valuable teachers in considerable numbers—though it is no doubt true that some of our best men have been lost in this manner, particularly in some institutions.

*Degrees Held by Teachers of Engineering Students.*—Through the coöperation of the Committee of the Missouri School of Mines and Metallurgy, your committee is able to present Table 7 which gives a summary of the degrees held by teachers in the several divisions of engineering curricula. There are some interesting contrasts presented by this table.

*Conclusion.*—We believe that there will be little disagreement with the statement that the real problem before us is that of securing the right type of teachers for our engineering faculties—that this constitutes a major problem in engineering education. On it hangs the satisfactory solution of our most serious educational problems. It has been well said that engineering education will never be better than its teachers. The data presented is, we believe, furnishing us with a reliable basis of fact which will help materially in deciding future course of action in this vital manner.

CHARLES H. WARREN, *Chairman.*

## PROJECT Ab1. A STUDY OF TEACHING PERSONNEL.

### PART 1. SUMMARY OF REPLIES TO QUESTIONNAIRE ON PARTICIPATION OF TEACHERS IN ENGINEERING PRACTICE, DEVELOPMENT OF TEACHING STAFFS, ETC.

Reports were received from the several types of institutions as follows:

| Key No. | Types of Institutions. | No. of Replies. | Key No. | Types of Institutions. | No. of Replies. |
|---|---|---|---|---|---|
| 1 | State Universities..... | 36 | 6 | Canadian Institutions... | 7 |
| 2 | Independent Universities . | 27 | 7 | Other State Institutions | 6 |
| 3 | Land Grant Colleges..... | 14 | 8 | State Military Colleges.. | 2 |
| 4 | Independent Polytechnic Institutes..... | 12 | 9 | Municipal Institutions.. | 2 |
| 5 | Independent Arts Colleges | 9 | 10 | Hawaiian Institutions... | 1 |
| | | | | Total..... | 116 |

POLICIES AS TO PARTICIPATION OF TEACHERS IN ENGINEERING PRACTICE DURING THE COLLEGE YEAR.

| Type of Institution. | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | Totals. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Outside work permitted | 33 | 27 | 12 | 12 | 9 | 7 | 6 | 2 | 2 | 1 | 111 | |
| Percentage | 91.7 | 100.0 | 85.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.7 | |
| Not permitted | 3 | | 2 | | | | | | | | 5 | |
| Percentage | 8.3 | | 14.3 | | | | | | | | 4.3 | 100.0 |
| Outside work encouraged | 18 | 21 | 5 | 9 | 9 | 6 | 5 | 1 | 1 | 1 | 76 | |
| Percentage | 50.0 | 77.8 | 35.7 | 75.0 | 100.0 | 85.8 | 83.3 | 50.0 | 50.0 | 100.0 | 68.5 | |
| Outside work tolerated | 14 | 6 | 6 | 2 | | | 1 | 1 | | | 30 | |
| Percentage | 38.9 | 22.2 | 42.9 | 16.7 | | | 16.7 | 50.0 | | | 27.0 | |
| Practice discouraged | 1 | | 1 | | | | | | 1 | | 3 | |
| Percentage | 2.8 | | 7.1 | | | | | | 50.0 | | 2.7 | |
| No answer | | | | 1 | | 1 | | | | | 2 | |
| Percentage | | | | 8.3 | | 14.2 | | | | | 1.8 | 100.0 |

*Limitations as to Amount and Character of Outside Work.*

Practically all institutions state that it is understood that outside practice must not interfere with regular teaching duties. Other explicit limitations take the following forms:

| Nature of Limitation. | Number of Institutions. |
|---|---|
| Outside work must be of a consulting nature only and must advance the teacher's professional standing | 15 |
| Permission of President or Trustees must be obtained | 6 |
| Permission of Dean or Director of Department must be obtained | 8 |
| Not less than two-thirds of teacher's time must be devoted to the institution | 1 |
| Teacher may give approximately one-eighth of time to outside work | 1 |
| There must be no direct competition with local practicing engineers (Municipal Institution) | 1 |
| Outside office must not be maintained | 1 |
| One-half of income derived from outside work goes to the institution | 1 |

ARRANGEMENTS FOR USE OF LABORATORY EQUIPMENT BY TEACHERS IN CONNECTION WITH OUTSIDE WORK.

| Type of Institution. | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Materials, power, etc. used must be paid for | 11 | 14 | 4 | 7 | 8 | | 3 | 1 | | 1 | 49 |
| Fee is paid for use of laboratory | 17 | 6 | 5 | 5 | | 6 | 3 | | 1 | | 43 |
| No specific arrangement | 3 | 6 | 2 | | 1 | | | 1 | | | 13 |
| Use of laboratories not permitted | | | 1 | | | 1 | | | 1 | | 3 |
| No reply | 2 | 1 | | | | | | | | | 3 |

LIMITATIONS ON USE OF THE NAME OF THE INSTITUTION IN CONNECTION WITH OUTSIDE WORK.

| | Number of Institutions. | Per Cent. |
|---|---|---|
| None, but the school is not responsible for the results | 23 | 20.7 |
| Professor may state his connection with the school | 12 | 10.8 |
| Professor must not state his connection with the school | 65 | 58.6 |
| No specific regulations, each case decided on its own merits, and miscellaneous replies | 6 | 5.4 |
| No reply | 5 | 4.5 |

*Assistance to Younger Teachers in Making Contacts with Industry.*

Ninety-two institutions (79.3 per cent.) state that more or less systematic methods are used to assist young Instructors to form contacts with industry or otherwise to broaden their experience. Twenty-one institutions (18.1 per cent.) state that no such efforts are made. Three institutions did not answer the question. The methods of assisting the younger teachers take various forms, ranging from definitely planned procedures to the giving of assistance only when or if an individual applies for it. The plan in operation at the New Mexico College of Agriculture and Mechanic Arts is described in the body of the report.

*Policies as to Sabbatical Years.*

Thirty-seven institutions (31.9 per cent.) state that a definite plan regarding sabbatical years is in effect. Seventy-six institutions (65.5 per cent.) state that there is no such plan applying to teachers of engineering. Three institutions did not answer the question. A total of 77 sabbatical leaves have been taken by teachers of engineering in 116 institutions during the last five years—an average of 15.4 leaves per year. Twenty-seven institutions permit sabbatical leaves of one year in seven on half pay, or one half year in seven on full pay. One institution grants leaves of one half year in three years or one year in six years on three fifths pay. One institution permits leaves of one year in eight on full pay. One institution which is in session for four quarters of the year permits leaves on full pay every third summer's quarter; the teacher to engage in advanced study during the period of leave. In many cases it is stipulated that faculty members must have served a minimum number of years before becoming eligible for sabbatical leave. In some cases it is also stipulated that the teacher must serve at least one year in the institution after having a sabbatical year.

*Systematic Instruction of Younger Teachers in the Art of Teaching.*

Twelve institutions (10.3 per cent.) state that systematic instruction is given to the younger members of the staff in the art of teaching. Twenty-four institutions (20.9 per cent.) state that it is customary for the older teachers to visit the class rooms of younger teachers. Thirty-eight institutions (32.8 per cent.) state that it is customary for the younger men to visit the classrooms of the more experienced teachers and to observe their methods. Fifty-four institutions state that neither of these practices are in effect. Eighty-four institutions (72.4 per cent.) state that they believe such methods as the above might be made of substantial value in improving the quality of instruction. Twenty-four institutions (20.7 per cent.) state that they do not feel that any such benefit would result. Eight institutions did not reply to this question.

The following quotations from replies were selected to indicate the range of opinion and practice in these matters.

(1) "There is no systematic instruction. The policy is rather to use great care in selection and to give the greatest possible freedom to the teachers in developing their individual methods. Heads of Departments soon learn who should be eliminated and who should not. Advice, suggestion and criticism are personal and informal."

(2) "No systematic instruction is given to the younger teachers in the art of teaching, excepting in the Department of Chemistry. In this particular department the head, who personally handles the work in general chemistry, insists that each instructor shall attend his class for the purpose of learning how to present the subject and in general how to teach chemistry."

(3) "There has been no systematic system of giving instruction in the art of teaching. Through the coöperation of our School of Vocational Teaching, the teachers in certain departments have formed groups to whom specialists in our educational department have given a series of lectures on methods of teaching."

"The plan has practically matured whereby a series of some six or eight lectures on methods of teaching will be given to all teachers in the institution within the next two or three months."

(4) "It is not customary for our older teachers to visit the classrooms of the more inexperienced teachers. Furthermore, I do not believe that this is a desirable practice because a visit of this sort almost inevitably throws the classroom into an artificial atmosphere so that neither students nor instructors can perform in a normal way. It has not been customary for our younger teachers to observe the methods of more experienced men. I think, however, this practice would yield good results if roster limitations would permit."

(5) "The feeling of our faculty is that our engineering schools need to give serious attention to teaching methods, but we are not in favor of the formal, abstract instruction which has been developed in the schools of education. Heads of departments may do much in the guidance of young members of their staffs, and it is believed by us that it should be handled there rather than by the School or College organization. The Department has a professional basis, and engineering teachers are usually selected on the basis of professional attainment. Those who have this professional basis in mind are the ones to develop their young teachers according to methods which are predicated on the professional viewpoint."

(6) "The matter embodied in the questions has been discussed at some of our faculty meetings and there is a difference of opinion on the subject. I think all agree that certain subjects pertaining to pedagogy would be valuable to the teacher. However, the younger men are keener to spend their spare time in professional work and the older men do not feel the necessity or urge to take up such subjects in a formal way."

(7) "There is a feeling by some members of the faculty that instruction in the art of teaching could be made of substantial value but experiments so far have not been satisfactory."

(8) "The staffs of some of the departments meet regularly and formally, others irregularly and informally, to discuss teaching methods and the problems which arise in conducting the department. Staffs which have these meetings often take dinner together and continue their discussions some times far into the night. It is a fact that the department which does this most systematically has the best teaching staff."

*Employment of Men Regularly Engaged in Industry as Part-time Teachers and Instruction Given to Industrial Employees by Members of the College Teaching Staffs.*

Thirty-one institutions (26.7 per cent.) state that they engage men regularly employed in industry as part-time or auxiliary teachers. Eighty-three institutions (71.6 per cent.) state that they do not follow this practice. Twenty-five institutions state that members of the engineering faculty give regular instruction to industrial employees in educational work carried out by the industries. In forty-four of the above institutions it is felt that these practices have been beneficial in general, while five institutions believe that the practices have been of no value or actually harmful.

# SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

## COMMITTEE ON TEACHING PERSONNEL

## STUDY OF ACADEMIC SALARIES AND SUPPLEMENTARY INCOMES OF TEACHERS OF ENGINEERING

2280 INDIVIDUALS IN 75 INSTITUTIONS IN THE UNITED STATES AND CANADA REPRESENTED.
PERCENTAGE OF RETURNS FROM THOSE CANVASSED – 80.

● REPRESENTS ACADEMIC SALARY

◉ REPRESENTS TOTAL INCOME (EXCLUDING ONLY INCOME DERIVED FROM INHERITANCES AND GIFTS) OF THOSE REPORTING SUPPLEMENTARY INCOMES.

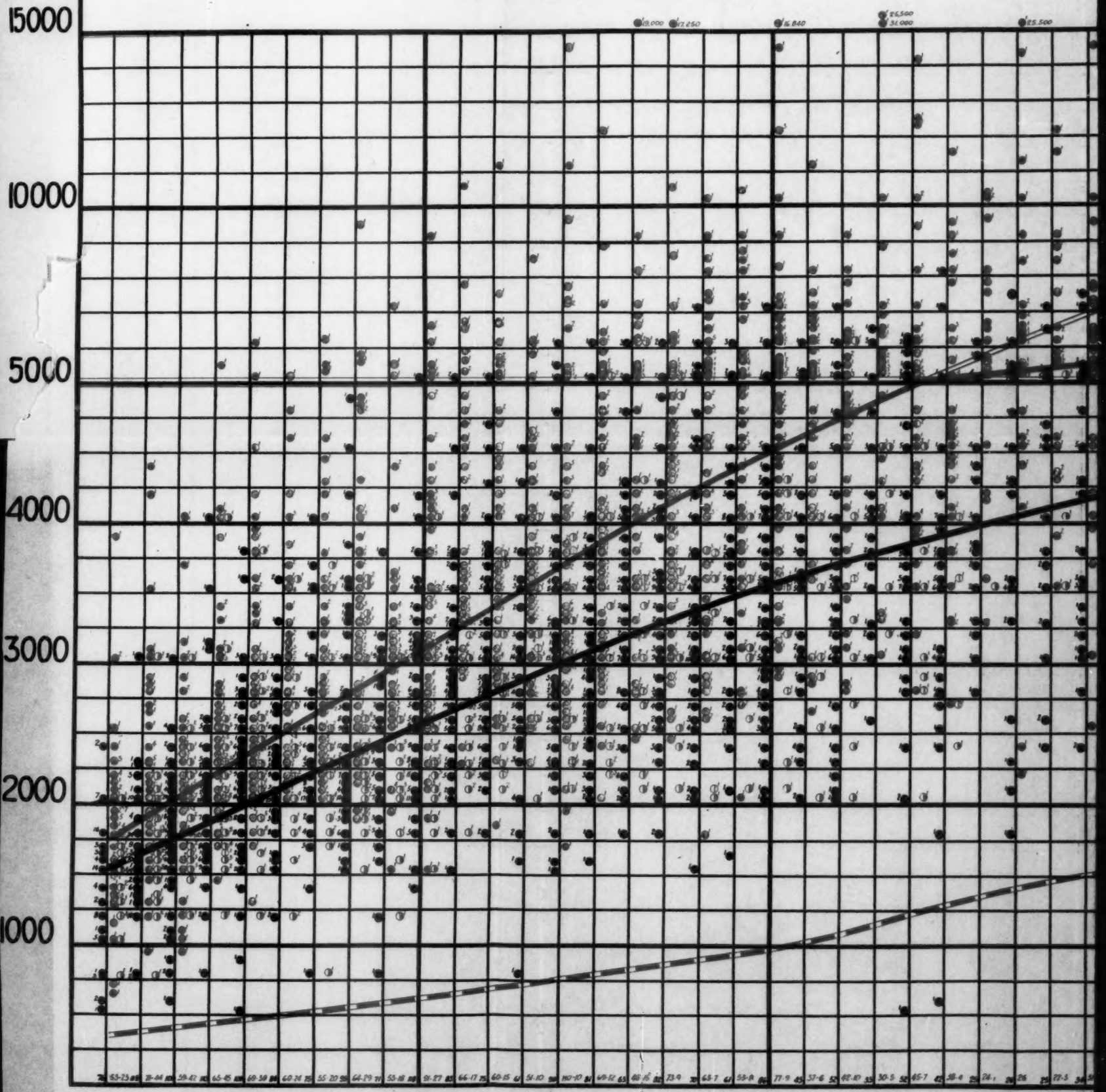
◑ REPRESENTS TOTAL INCOME OF THOSE REPORTING NO SUPPLEMENTARY INCOME.

CURVE OF MEDIAN ACADEMIC SALARIES.

CURVE OF MEDIAN TOTAL INCOMES, ALL INDIVIDUALS INCLUDED.

CURVE OF MEDIAN SUPPLEMENTARY INCOMES, ONLY THOSE REPORTING SUCH INCOMES INCLUDED.

YEARS SINCE OBTAINING FIRST DEGREE AS OF JUNE 1, 1925.
INCOMES FOR CALENDER YEAR 1924.



G

Y

IDIVIDUALS

ES, ONLY
LUDED.

ES 500

SCALE -1 SPACE = $250
$6500

SCALE -1 SPACE = $1000

50,000
30,000
15000
10000
5000
4000
3000
2000
1000

30
40
50

NING FIRST DEGREE

TABLE 1.—*Continued.*

| Years Since First Degree was Obtained. | Total Number Reporting. | Individuals Reporting Supplementary Incomes. | | Annual Academic Salaries. | | Median Annual Supplementary Incomes of those Reporting Same. | Annual Total Incomes. | |
|---|---|---|---|---|---|---|---|---|
| | | Number. | Per Cent. | Median. | Most Frequent. | | Median of those Reporting Supplementary Incomes. | Median, All Individuals Included. |
| 26 | 25 | 24 | 96.0 | 4,300 | *4,500–5,000 | 1,550 | 5,300 | 5,250 |
| 27 | 26 | 26 | 100.0 | 4,225 | *3,500–4,500 | 1,700 | 5,750 | 5,750 |
| 28 | 25 | 22 | 88.0 | 4,500 | 5,000 | 1,475 | 5,700 | 5,550 |
| 29 | 34 | 31 | 91.3 | 4,000 | 4,500 | 1,375 | 5,850 | 5,500 |
| 30 | 47 | 37 | 78.7 | 4,400 | 5,000 | 1,700 | 6,700 | 5,600 |
| †31 | 25 | 22 | 88.0 | 4,225 | *4,500–5,000–6,000 | 1,550 | 6,000 | 5,825 |
| †32 | 21 | 21 | 100.0 | 4,200 | 5,000 | 1,800 | 6,550 | 6,000 |
| †33 | 15 | 12 | 80.0 | 4,225 | 4,000 | 1,350 | 6,000 | 5,825 |
| †34 | 22 | 20 | 91.0 | 4,275 | 4,500 | 1,650 | 6,000 | 5,725 |
| †35 | 21 | 18 | 85.7 | 4,400 | 4,500 | 1,377 | 6,000 | 5,600 |
| †36 | 11 | 10 | 91.0 | 4,500 | 4,500 | 1,200 | 5,650 | 5,150 |
| †37 | 12 | 10 | 83.3 | 4,500 | 4,500 | 1,000 | 5,500 | 5,400 |
| †38 | 11 | 10 | 91.0 | 4,500 | 4,500 | 1,333 | 6,000 | 5,950 |
| †39 | 10 | 9 | 90.0 | 4,650 | *4,500–6,000 | 1,402 | 6,600 | 6,000 |
| †40 | 14 | 13 | 93.0 | 4,800 | 6,000 | 1,775 | 6,800 | 6,600 |
| †41 | 7 | 6 | 85.7 | 5,000 | 6,000 | 2,100 | 7,500 | 7,250 |
| †42 | 6 | 6 | 100.0 | 4,800 | 6,000 | 2,000 | 6,800 | 6,600 |
| †43 | 5 | 4 | 80.0 | 5,000 | 6,000 | 1,800 | 7,500 | 6,400 |
| †44 | 3 | 2 | 66.7 | 4,800 | 6,000 | 3,000 | 6,000 | 6,000 |
| †45 | 1 | 1 | 100.0 | 4,500 | *3,000–4,000 5,000–6,000 | 2,100 | 6,250 | 6,500 |
| 46 | 2 | 2 | | | | | | |
| 47 | 4 | 3 | | | | | | |
| 48 | 2 | 2 | | | | | | |
| 49 | 1 | 1 | | | | | | |
| 50 | 0 | 0 | | | | | | |
| 51 | 1 | 1 | | | | | | |
| 52 | 0 | 0 | | | | | | |
| 53 | 1 | 1 | | | | | | |
| 54 | 0 | 0 | | | | | | |
| 55 | 1 | 0 | | | | | | |

Medians have not been computed because of small number of individuals.

* Equal numbers of salaries of amounts shown reported.

† Medians computed for five-year period.

TABLE 2. MAXIMUM AND MINIMUM ACADEMIC SALARIES REPORTED. 2,279 Individuals in 75 Institutions Included.

| Years Since First Degree was Obtained. | Maximum Academic Salary Reported. | Minimum Academic Salary Reported. | Years Since First Degree was Obtained. | Maximum Academic Salary Reported. | Minimum Academic Salary Reported. | Years Since First Degree was Obtained. | Maximum Academic Salary Reported. | Minimum Academic Salary Reported. |
|---|---|---|---|---|---|---|---|---|
| 1 | $2,400 | $ 500 | 16 | $6,000 | $1,800 | 31 | $8,000 | $2,200 |
| 2 | 3,050 | 750 | 17 | 6,000 | 1,800 | 32 | 7,000 | 3,000 |
| 3 | 3,000 | 600 | 18 | 7,000 | 1,600 | 33 | 6,000 | 2,400 |
| 4 | 4,000 | 800 | 19 | 6,000 | 1,650 | 34 | 7,200 | 2,600 |
| 5 | 3,800 | 500 | 20 | 7,000 | 2,000 | 35 | 7,000 | 2,000 |
| 6 | 3,600 | 1,200 | 21 | 6,000 | 2,000 | 36 | 7,000 | 2,100 |
| 7 | 4,000 | 800 | 22 | 7,000 | 2,000 | 37 | 6,000 | 2,400 |
| 8 | 4,900 | 1,500 | 23 | 6,500 | 2,600 | 38 | 6,300 | 3,500 |
| 9 | 3,800 | 800 | 24 | 6,300 | 2,000 | 39 | 8,000 | 2,250 |
| 10 | 5,000 | 1,400 | 25 | 8,000 | 1,800 | 40 | 7,500 | 2,400 |
| 11 | 5,000 | 1,500 | 26 | 6,000 | 2,800 | 41 | 7,200 | 4,200 |
| 12 | 5,000 | 1,800 | 27 | 7,500 | 1,800 | 42 | 6,000 | 1,800 |
| 13 | 4,500 | 800 | 28 | 7,000 | 2,600 | 43 | 5,000 | 3,500 |
| 14 | 6,000 | 1,500 | 29 | 7,500 | 2,400 | 44 | 6,000 | 3,000 |
| 15 | 6,000 | 1,600 | 30 | 10,000 | 1,500 | 45 | 4,000 | 4,000 |

*Summary of Salary Scales in 69 Representative Institutions.*

TABLE 3. STUDY OF ACADEMIC SALARIES AND SUPPLEMENTARY INCOMES OF TEACHERS OF ENGINEERING IN THE UNITED STATES AND CANADA.

| Rank. | No. of Each Rank Reporting. | Maximum. | Minimum. | Median. | Most Frequent. |
|---|---|---|---|---|---|
| Dean | 54 | $10,000 | $2,500 | $5,000 | $5,000 |
| Professor | 700 | 7,500 | 2,500 | 4,000 | 4,000 |
| Associate Professor | 350 | 6,000 | 2,000 | 3,300 | 3,500 |
| Assistant Professor | 539 | 5,000 | 1,500 | 2,700 | 2,500 |
| Instructor | 831 | 3,000 | 900 | 2,000 | 2,000 |
| Assistant | 137 | 2,400 | 250 | 800 | 800 |
| "Associate" | 20 | 4,500 | 2,200 | 2,500 | 2,500 |
| TOTAL | 2,631 | | | | |

## PART 2. STUDY OF ACADEMIC SALARIES AND SUPPLEMENTARY INCOMES OF TEACHERS OF ENGINEERING IN THE UNITED STATES AND CANADA.

### TABLE 1.

2,279 Individuals Reporting.
Years Since First Degree was Obtained, as of June, 1925.
Incomes for Calendar Year 1924.
75 Institutions Represented, as Follows:
23 in New England and Middle Atlantic States,
10 in Rocky Mountain States,
4 in Pacific Coast States,
5 in Canada,
13 in Southern States,
20 in Middle Western States.

| Years Since First Degree was Obtained. | Total Number Reporting. | Individuals Reporting Supplementary Incomes. | | Annual Academic Salaries. | | Median Annual Supplementary Incomes of those Reporting Same. | Annual Total Incomes. | |
|---|---|---|---|---|---|---|---|---|
| | | Number. | Per Cent. | Median. | Most Frequent. | | Median of those Reporting Supplementary Incomes. | Median, All Individuals Included. |
| 1 | 76 | 53 | 69.8 | $1,500 | $1,800 | $ 300 | $1,900 | $1,750 |
| 2 | 115 | 71 | 61.7 | 1,700 | 1,800 | 400 | 2,000 | 1,900 |
| 3 | 101 | 59 | 58.5 | 1,800 | 2,000 | 325 | 2,100 | 2,000 |
| 4 | 110 | 65 | 59.0 | 1,900 | 1,800 | 393 | 2,400 | 2,200 |
| 5 | 108 | 69 | 63.9 | 2,000 | *1,800–2,000 | 483 | 2,700 | 2,400 |
| 6 | 83 | 59 | 71.1 | 2,225 | 2,000 | 550 | 2,900 | 2,675 |
| 7 | 75 | 55 | 73.4 | 2,200 | 2,000 | 500 | 2,850 | 2,700 |
| 8 | 93 | 64 | 68.9 | 2,400 | 2,400 | 600 | 3,100 | 2,850 |
| 9 | 71 | 53 | 74.6 | 2,400 | *2,400–3,000 | 600 | 3,075 | 3,000 |
| 10 | 118 | 91 | 77.1 | 2,550 | 3,000 | 625 | 3,300 | 3,075 |
| 11 | 83 | 66 | 79.5 | 2,800 | 2,700 | 679 | 3,550 | 3,300 |
| 12 | 75 | 60 | 80.0 | 2,850 | 2,500 | 700 | 3,750 | 3,550 |
| 13 | 61 | 51 | 83.6 | 3,000 | 3,000 | 600 | 3,550 | 3,500 |
| 14 | 90 | 80 | 88.9 | 3,000 | 3,000 | 600 | 3,525 | 3,450 |
| 15 | 81 | 69 | 85.2 | 3,000 | 3,000 | 795 | 3,900 | 3,800 |
| 16 | 63 | 48 | 76.2 | 3,000 | 2,800 | 800 | 4,150 | 4,000 |
| 17 | 82 | 73 | 89.0 | 3,200 | 3,000 | 600 | 4,000 | 4,000 |
| 18 | 70 | 63 | 90.0 | 3,300 | 3,000 | 880 | 4,200 | 4,050 |
| 19 | 61 | 53 | 87.0 | 3,600 | 4,000 | 720 | 4,850 | 4,550 |
| 20 | 86 | 77 | 89.6 | 3,500 | 4,000 | 1,200 | 4,875 | 4,600 |
| 21 | 43 | 37 | 86.1 | 3,625 | *3,500–5,000 | 1,000 | 4,900 | 4,500 |
| 22 | 52 | 42 | 80.8 | 3,500 | *3,000–4,000 | 1,210 | 4,800 | 4,700 |
| 23 | 35 | 30 | 85.7 | 4,000 | 4,000 | 1,350 | 5,400 | 5,250 |
| 24 | 52 | 45 | 86.5 | 3,700 | 3,500 | 1,000 | 4,750 | 4,500 |
| 25 | 42 | 38 | 90.5 | 3,600 | 4,000 | 1,000 | 4,600 | 4,500 |

TABLE 1.—*Continued.*

| Years Since First Degree was Obtained. | Total Number Reporting. | Individuals Reporting Supplementary Incomes. | | Annual Academic Salaries. | | Median Annual Supplementary Incomes of those Reporting Same. | Annual Total Incomes. | |
|---|---|---|---|---|---|---|---|---|
| | | Number. | Per Cent. | Median. | Most Frequent. | | Median of those Reporting Supplementary Incomes. | Median, All Individuals Included. |
| 26 | 25 | 24 | 96.0 | 4,300 | *4,500–5,000 | 1,550 | 5,300 | 5,250 |
| 27 | 26 | 26 | 100.0 | 4,225 | *3,500–4,500 | 1,700 | 5,750 | 5,750 |
| 28 | 25 | 22 | 88.0 | 4,500 | 5,000 | 1,475 | 5,700 | 5,550 |
| 29 | 34 | 31 | 91.3 | 4,000 | 4,500 | 1,375 | 5,850 | 5,500 |
| 30 | 47 | 37 | 78.7 | 4,400 | 5,000 | 1,700 | 6,700 | 5,600 |
| †31 | 25 | 22 | 88.0 | 4,225 | *4,500–5,000–6,000 | 1,550 | 6,000 | 5,825 |
| †32 | 21 | 21 | 100.0 | 4,200 | 5,000 | 1,800 | 6,550 | 6,000 |
| †33 | 15 | 12 | 80.0 | 4,225 | 4,000 | 1,350 | 6,000 | 5,825 |
| †34 | 22 | 20 | 91.0 | 4,275 | 4,500 | 1,650 | 6,000 | 5,725 |
| †35 | 21 | 18 | 85.7 | 4,400 | 4,500 | 1,377 | 6,000 | 5,600 |
| †36 | 11 | 10 | 91.0 | 4,500 | 4,500 | 1,200 | 5,650 | 5,150 |
| †37 | 12 | 10 | 83.3 | 4,500 | 4,500 | 1,000 | 5,500 | 5,400 |
| †38 | 11 | 10 | 91.0 | 4,500 | 4,500 | 1,333 | 6,000 | 5,950 |
| †39 | 10 | 9 | 90.0 | 4,650 | *4,500–6,000 | 1,402 | 6,600 | 6,000 |
| †40 | 14 | 13 | 93.0 | 4,800 | 6,000 | 1,775 | 6,800 | 6,600 |
| †41 | 7 | 6 | 85.7 | 5,000 | 6,000 | 2,100 | 7,500 | 7,250 |
| †42 | 6 | 6 | 100.0 | 4,800 | 6,000 | 2,000 | 6,800 | 6,600 |
| †43 | 5 | 4 | 80.0 | 5,000 | 6,000 | 1,800 | 7,500 | 6,400 |
| †44 | 3 | 2 | 66.7 | 4,800 | 6,000 | 3,000 | 6,000 | 6,000 |
| †45 | 1 | 1 | 100.0 | 4,500 | *3,000–4,000 5,000–6,000 | 2,100 | 6,250 | 6,500 |
| 46 | 2 | 2 | | | | | | |
| 47 | 4 | 3 | | | | | | |
| 48 | 2 | 2 | | | | | | |
| 49 | 1 | 1 | | | | | | |
| 50 | 0 | 0 | | | | | | |
| 51 | 1 | 1 | | | | | | |
| 52 | 0 | 0 | | | | | | |
| 53 | 1 | 1 | | | | | | |
| 54 | 0 | 0 | | | | | | |
| 55 | 1 | 0 | | | | | | |

Medians have not been computed because of small number of individuals.

* Equal numbers of salaries of amounts shown reported.

† Medians computed for five-year period.

TABLE 2. MAXIMUM AND MINIMUM ACADEMIC SALARIES REPORTED. 2,279 Individuals in 75 Institutions Included.

| Years Since First Degree was Obtained. | Maximum Academic Salary Reported. | Minimum Academic Salary Reported. | Years Since First Degree was Obtained. | Maximum Academic Salary Reported. | Minimum Academic Salary Reported. | Years Since First Degree was Obtained. | Maximum Academic Salary Reported. | Minimum Academic Salary Reported. |
|---|---|---|---|---|---|---|---|---|
| 1 | $2,400 | $ 500 | 16 | $6,000 | $1,800 | 31 | $8,000 | $2,200 |
| 2 | 3,050 | 750 | 17 | 6,000 | 1,800 | 32 | 7,000 | 3,000 |
| 3 | 3,000 | 600 | 18 | 7,000 | 1,600 | 33 | 6,000 | 2,400 |
| 4 | 4,000 | 800 | 19 | 6,000 | 1,650 | 34 | 7,200 | 2,600 |
| 5 | 3,800 | 500 | 20 | 7,000 | 2,000 | 35 | 7,000 | 2,000 |
| 6 | 3,600 | 1,200 | 21 | 6,000 | 2,000 | 36 | 7,000 | 2,100 |
| 7 | 4,000 | 800 | 22 | 7,000 | 2,000 | 37 | 6,000 | 2,400 |
| 8 | 4,900 | 1,500 | 23 | 6,500 | 2,600 | 38 | 6,300 | 3,500 |
| 9 | 3,800 | 800 | 24 | 6,300 | 2,000 | 39 | 8,000 | 2,250 |
| 10 | 5,000 | 1,400 | 25 | 8,000 | 1,800 | 40 | 7,500 | 2,400 |
| 11 | 5,000 | 1,500 | 26 | 6,000 | 2,800 | 41 | 7,200 | 4,200 |
| 12 | 5,000 | 1,800 | 27 | 7,500 | 1,800 | 42 | 6,000 | 1,800 |
| 13 | 4,500 | 800 | 28 | 7,000 | 2,600 | 43 | 5,000 | 3,500 |
| 14 | 6,000 | 1,500 | 29 | 7,500 | 2,400 | 44 | 6,000 | 3,000 |
| 15 | 6,000 | 1,600 | 30 | 10,000 | 1,500 | 45 | 4,000 | 4,000 |

*Summary of Salary Scales in 69 Representative Institutions.*

TABLE 3. STUDY OF ACADEMIC SALARIES AND SUPPLEMENTARY INCOMES OF TEACHERS OF ENGINEERING IN THE UNITED STATES AND CANADA.

| Rank. | No. of Each Rank Reporting. | Maximum. | Minimum. | Median. | Most Frequent. |
|---|---|---|---|---|---|
| Dean | 54 | $10,000 | $2,500 | $5,000 | $5,000 |
| Professor | 700 | 7,500 | 2,500 | 4,000 | 4,000 |
| Associate Professor | 350 | 6,000 | 2,000 | 3,300 | 3,500 |
| Assistant Professor | 539 | 5,000 | 1,500 | 2,700 | 2,500 |
| Instructor | 831 | 3,000 | 900 | 2,000 | 2,000 |
| Assistant | 137 | 2,400 | 250 | 800 | 800 |
| "Associate" | 20 | 4,500 | 2,200 | 2,500 | 2,500 |
| TOTAL | 2,631 | | | | |

TABLE 4. COMPARISON OF SALARIES AND TOTAL EARNINGS OF ENGINEERING TEACHERS WITH EARNINGS OF ENGINEERING GRADUATES IN PRACTICE.

(All values taken from smooth curves.)

| Years After Graduation. | Median Annual Academic Salaries of Teachers. | Median Total Annual Earned Income of Teachers. | Median Total Annual Earnings of Graduates. | Ratio: Salary of Teachers to Earnings of Graduates. | Ratio: Total Income of Teachers to Earnings of Graduates. |
|---|---|---|---|---|---|
| 0* | $1,500 | $1,500 | $1,475 | 1.02 | 1.02 |
| 1 | 1,500 | 1,750 | 1,800 | .83 | .97 |
| 2 | 1,700 | 1,900 | 2,100 | .81 | .905 |
| 5 | 2,000 | 2,350 | 2,860 | .70 | .82 |
| 10 | 2,550 | 3,100 | 4,000 | .64 | .775 |
| 15 | 3,100 | 3,825 | 5,000 | .62 | .765 |
| 20 | 3,600 | 4,500 | 5,900 | .61 | .76 |
| 30 | 4,225 | 5,550 | 7,500 | .56 | .74 |

* First appointment.

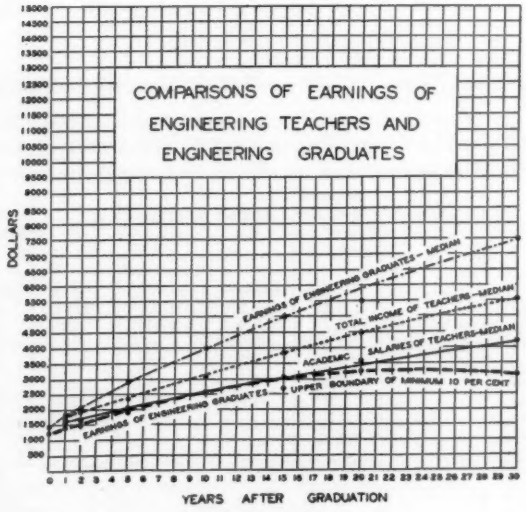

COMPARISONS OF EARNINGS OF ENGINEERING TEACHERS AND ENGINEERING GRADUATES
DOLLARS
YEARS AFTER GRADUATION
EARNINGS OF ENGINEERING GRADUATES—MEDIAN
TOTAL INCOME OF TEACHERS—MEDIAN
ACADEMIC SALARIES OF TEACHERS—MEDIAN
EARNINGS OF ENGINEERING GRADUATES—UPPER BOUNDARY OF MINIMUM 10 PER CENT

TABLE 5. TABLE SHOWING SOURCES FROM WHICH TEACHERS WERE OBTAINED.

Figures Give the Numbers Obtained from Each Source during the Calendar Years 1920 to 1924 Inclusive.

| Rank. | By Promotion in Staff of Same Institution. | From Staff of Another Institution. | From Graduating Class of Same Institution. | From Graduating Class of Another Institution. | Total from Teaching Staffs or Graduating Classes Cols. 2 to 5 Incl. | From Engineering Practice. | From Other Sources. | Totals Cols. 6 to 8 Inc. | Present Numbers of Each Rank in Institutions Represented. |
|---|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Dean: No. | 16 | 12 | | | 28 | 4 | | 32 | 70 |
| % | 50.0 | 37.5 | | | 87.5 | 12.5 | | | |
| Prof.: No. | 83 | 47 | | | 130 | 37 | 8 | 175 | 487 |
| % | 47.4 | 26.8 | | | 74.3 | 21.2 | 4.6 | | |
| Asso. Prof.: No. | 104 | 30 | | | 134 | 34 | | 168 | 207 |
| % | 61.9 | 17.9 | | | 79.8 | 20.2 | | | |
| Asst. Prof.: No. | 163 | 112 | 14 | 5 | 294 | 79 | 7 | 380 | 376 |
| % | 42.9 | 29.4 | 3.8 | 1.3 | 77.4 | 20.8 | 1.8 | | |
| Instr.: No. | 57 | 178 | 223 | 117 | 575 | 334 | 59 | 968 | 630 |
| % | 5.9 | 18.4 | 23.1 | 12.1 | 59.4 | 34.5 | 6.0 | | |
| Asst.: No. | | 9 | 26 | 21 | 56 | 21 | 2 | 79 | 94 |
| % | | 11.4 | 32.9 | 26.6 | 70.9 | 26.6 | 2.5 | | |
| Unclassified: No. | 1 | 18 | 26 | 1 | 46 | 19 | 17 | 82 | 84 |
| % | 1.2 | 22.0 | 31.7 | 1.2 | 56.1 | 23.2 | 20.7 | | |
| Totals: No. | 424 | 406 | 289 | 144 | 1,263 | 528 | 93 | 1,884 | 1,948 |
| % | 22.6 | 21.6 | 15.3 | 7.6 | 67.1 | 28.0 | 4.9 | | |

TABLE 6. TABLE SHOWING LOSS OF TEACHERS OVER A FIVE-YEAR PERIOD, 1920 TO 1924 INCLUSIVE.

| Rank. | Left to Take Another Teaching Position. | Left to Enter Field of Engineering Practice. | Left to Enter Business. | Left to Enter Other Fields. | Total Losses for 5 Year Period Cols. 3, 4 and 5. | Present Total Numbers in Institutions Represented. | Percentage Loss of Each Rank Per Year. |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Dean | 6 | 4 | 3 | 4 | 11 | 70 | 3.1 |
| Professor | 36 | 36 | 7 | 15 | 58 | 487 | 2.4 |
| Associate Professor | 21 | 25 | 5 | 2 | 32 | 207 | 3.1 |
| Assistant Professor | 67 | 57 | 22 | 11 | 90 | 376 | 4.8 |
| Instructor | 171 | 274 | 65 | 70 | 409 | 630 | 13.0 |
| Assistant | 19 | 23 | 1 | 8 | 32 | 94 | 6.8 |
| Unclass'd | 8 | 16 | 3 | 5 | 24 | 84 | 5.7 |
| TOTALS | 328 | 435 | 106 | 115 | 656 | 1,948 | 6.7 |
| Percentage per year of present total number of teachers | 3.37 | 4.46 | 1.09 | 1.18 | 6.73 | | |

*Remarks.*—Teachers deceased or retired are not included in the tables. Average percentage yearly loss, professional grades—3.35 per cent. Average percentage yearly loss, lower grades—11.5 per cent. Total percentage turnover per year—10.1 per cent.

TABLE 7. SUMMARY OF DEGREES HELD BY TEACHERS OF ENGINEERING STUDENTS.

143 Institutions Included.

| Degrees. | Teachers of Engineering Subjects Including Mechanics. | | Teachers of Chemistry and Chemical Engineering. | | Teachers of Sciences, Including Mathematics. | | Teachers of English and Modern Languages. | | Teachers of Economics and Business. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | %. | No. | %. | No. | %. | No. | %. | No. | %. |
| Dr. Eng. | 15 | 0.40 | 1 | 0.01 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Dr. Sc. | 66 | 1.79 | 43 | 2.83 | 66 | 2.65 | 3 | 0.12 | 3 | 0.29 |
| Ph.D. | 95 | 2.57 | 484 | 31.76 | 601 | 24.56 | 502 | 20.37 | 197 | 19.74 |
| Professional Degrees, C.E., E.E., M.E., etc. | 1,086 | 29.40 | 41 | 2.68 | 131 | 5.24 | 5 | 0.21 | 22 | 2.20 |
| M.S. with specification as M.S. in C.E. | 109 | 2.95 | 12 | 0.78 | 11 | 0.35 | 1 | 0.05 | 1 | 0.10 |
| M.S. without specification | 245 | 6.64 | 267 | 17.49 | 254 | 10.12 | 17 | 0.69 | 23 | 2.30 |
| B.S. with and without specification | 1,113 | 30.14 | 199 | 13.09 | 267 | 10.71 | 70 | 2.85 | 73 | 7.39 |
| A.B., Ph.B., etc. | 232 | 6.28 | 186 | 12.18 | 487 | 19.85 | 791 | 32.09 | 250 | 25.03 |
| M.A. | 116 | 3.15 | 207 | 13.56 | 517 | 20.06 | 859 | 34.83 | 251 | 25.13 |
| L.L.D., Litt.D., etc. | 19 | 0.51 | 14 | 0.91 | 47 | 1.87 | 53 | 2.15 | 24 | 2.42 |
| Other Degrees. | 76 | 2.06 | 48 | 3.14 | 72 | 2.96 | 121 | 4.90 | 138 | 13.82 |
| No Degrees | 521 | 14.10 | 24 | 1.57 | 41 | 1.63 | 43 | 1.74 | 16 | 1.59 |
| Total Number of Degrees | 3,693 | | 1,526 | | 2,494 | | 2,465 | | 998 | |
| Total Number of Teachers | 3,159 | | 1,086 | | 1,852 | | 1,835 | | 666 | |

## THE ENGLISH DEPARTMENT.

### Inter-Departmental Coöperation to Promote the Habitual Use of Correct English.

BY W. OTTO BIRK,

University of Colorado.

*Note:* Professor Birk's report was the subject of discussion at one of the conferences at the Schenectady meeting of the S. P. E. E. last June. It covers one phase of the survey of the status of the teaching of English in the colleges of engineering now being made by the Committee on English,—in my judgment a most vital phase and one regarding which there seems to be some confusion. As I see it, the case stands about as follows. The professional careers of our engineering students are destined to be powerfully affected by their ability to speak and write correctly and effectively. One of the objectives in the teaching of English in the engineering college is, therefore, to secure the natural and habitual use of correct English by the students. Such habits of accurate speech cannot be imparted to them in any magical way by a prescribed number of English courses if their use of English is neglected elsewhere. They cannot be established by the unaided efforts of the teachers of English, but only by the whole-hearted and intelligent cooperation of all the members of the faculty.

Regarding the need for such coöperation, I believe there can be no difference of opinion. The means for realizing it, however, are various and in a decidedly experimental stage. Regarding them there is bound to be diversity of opinion, since what is useful in one set of conditions does not apply to another. The Committee solicits additional information on experiments being made of ways and means, but it is most concerned with spreading the gospel of coöperation,—the sharing of responsibility for the student's habits of English usage by all who in any way contribute to his training.

J. Raleigh Nelson,
*Chairman.*

One weakness frequently charged against our formal classroom method of teaching English composition is that it fails to promote the natural and habitual use of correct English. Of those teachers who have recognized this defect, many have

stated that the most effective remedy is that of having all members of the faculty coöperate in encouraging the student in the natural and habitual use of correct English, or of what are sometimes called the "common decencies" of our language.

In order to assemble first-hand information on this subject, the Committee on English of this Society, as part of its survey of the teaching of English in the technical schools of the United States and Canada, has made an inquiry into the value of inter-departmental coöperation as an aid in building up habitual good usage. The intention of the Committee was not to prove a case for or against the method, but merely to discover (1) how many schools were using a plan of coöperation and (2) the value that teachers of English attach to the plan—even if they are not using it.

This information was secured by sending the following questionnaire to teachers of English—either to the heads of general departments, or, where possible, to instructors in charge of engineering students:

I. Will you please explain any plan that you may have *in use* for the coöperative teaching of English composition; that is, a plan that encourages students to use correct English in all classes and not merely when they are in a class in English composition?

Is the plan used in the college of engineering exclusively?

In which other college or colleges is it used?

(The following questions are given as suggestions for topics to be covered in the discussion. *If you have not time enough to write a lengthy explanation, "yes" or "no" answers after each question will be appreciated.*)

*a.* Does the department of English grade papers written in other departments?

*b.* Do instructors in English assist in preparing papers (reports, for instance) for other departments?

*c.* Is the grade on papers written in other departments affected in any way by the grade given or by the recommendation made by the department of English?

*d.* Even if the grade is not affected, are students required to correct or rewrite papers in order to meet a certain standard?

*e.* Are instructors in other departments expected to deduct a certain amount for faulty use of English in papers written for

their departments and not inspected or graded by the department of English?

*f*. Have you any definitely specified minimum requirements to guide instructors in checking errors in English? (If you have, will you please submit a copy?)

*g*. Has the plan that you are using any marked weaknesses?

*h*. Have you statistics that show the correlation between grades given papers by an instructor in a technical subject and grades given the same papers by an instructor in English? The grades given these papers by the instructor in the technical subject should be based upon content only, and not upon correctness of expression. The object is to find out if students who make high grades in their technical subjects are generally careful in their use of English?

(If you have these statistics, will you please present them?)

II. Whether or not you have *in use* a plan of coöperative teaching of English composition, will you please state frankly what you think of the plan?

(The following questions are given as suggestions for topics to be covered in the discussion. *If you have not time to write a lengthy discussion, brief answers written after each question will be appreciated.*)

*a*. Would a coöperative plan of teaching English composition, as indicated by the questions under topic I, promote the habitual use of correct English?

*b*. Do you think that a plan of this sort is fundamental; that is, can the best results in teaching English composition be obtained without it?

*c*. Is the plan feasible?

By suggesting some possible means of coöperation, the questions under Part I aid in defining this plan. A few additional comments, however, seem necessary. In the first place, the Committee did not have in mind the necessity of any elaborately organized machinery of coöperation, but merely a definite and continuous procedure whereby teachers of English and other teachers work together to promote the habitual use of correct English.

Obviously, this kind of a plan has limitations. Its use should not be expected to solve all difficulties in teaching composition; nor should it be expected to solve any of them completely. It cannot, for instance, insure correct usage; it can

only promote it. Furthermore, it can scarcely promote more than observance of the "common decencies."

The definition provided by the questions indicates, too, that the investigation did not consider the various plans for remanding to the department of English for further work those students found to be deficient in composition by instructors in non-English courses or by general examinations.

Answers to the questionnaire were received from fifty-one institutions. Of these fifty-one, six reported a plan of this type in use. These were the Polytechnic Institute of Brooklyn, Worcester Polytechnic Institute, Clarkson College of Technology, the University of Cincinnati, the University of Colorado, and the James Milliken University. At the University of Cincinnati and at the University of Colorado the plan is used only in the college of engineering; but at the James Milliken University it is used in the whole institution. Others stated that they were using some form of coöperation as represented by one or two questions under Part I, but the coöperation was neither definite nor consistent enough to be called a working plan. If a plan is being used by any school not mentioned here, the Committee would be glad to have an account of it.

The most thorough and elaborate of these plans is the one used in the College of Engineering at the University of Cincinnati. Since it includes most of the features suggested in the questionnaire, an explanation of its operation might be worth while.

All papers containing connected discourse are presented first to the department of English. Thus they must meet the requirements of this department before they are passed over to the technical departments for which they were especially prepared. Papers not meeting the standards must be rewritten until they do. Though the technical instructor does not deduct a certain per cent. for faulty composition, the paper may never get to the technical instructor; and so a severe penalty—a zero on the paper—may be imposed.

More important, perhaps, than a summary of the plans in

use, are the opinions about the value of coöperation as given both by those using a plan and by those not using one. These opinions were given in answer to the questions under Part II of the questionnaire. Many were discussions based upon the questions, and some were merely "yes" or "no" answers. For convenience, all have been tabulated under the heads of "Yes," "No," or "Doubtful," and are recorded in the following tables both in numbers and in percentages. As will be noted, all of those who answered the questionnaire did not answer every question.

TABLE *A*.

| Question. | Yes. | No. | Doubtful. |
|---|---|---|---|
| IIa | 42 | 4 | 0 |
| IIb | 28 | 9 | 3 |
| IIc | 20 | 6 | 20 |

TABLE *B*.

| Question. | Yes. | No. | Doubtful. |
|---|---|---|---|
| IIa | 91+% | 9−% | 0 |
| IIb | 70 % | 22+% | 7 % |
| IIc | 43+% | 13+% | 43+% |

Though forty-two believe that a plan similar to that in use at Cincinnati would promote the habitual use of good English, some think that it is merely desirable, but not necessary. They believe that it would stimulate habitual good usage, but they feel as if other methods might bring similar results. On the other hand, twenty-eight, or 70 per cent. of the forty who answered this part of the questionnaire, stated that the best results in English composition cannot be obtained without coöperation.

The feasibility of any definite plan, however, was doubted by many—even by those who favored coöperation in general. Only six stated positively that it is not feasible; whereas twenty, including the six using the plan, were equally positive that it is feasible. A similar number were doubtful.

The reasons given for doubting the feasibility may be summarized as follows:

1. Instructors in non-English subjects lack accurate knowledge of good English to be able to coöperate intelligently.

2. Departments of English have neither sufficient help nor time to undertake the extra work that would be necessary.

3. Instructors in non-English subjects have not enough interest in good English to promote correct usage, or else they do not realize the importance of good English.

4. The burden of the work would fall upon the department of English.

Perhaps a more complete understanding of these opinions can be gained from excerpts from some of the discussions. Comments that refer to specific questions under Part II are here indicated only when necessary for clarity, in which case the questions are indicated by the letter *a*, *b*, or *c*.

"Frankly, a request for coöperation is really a request for a favor which, fully understood, would not be granted. Such plans are usually one-sided; the burden is almost always on the English Department's end of the stick."

"Good plan. I've proposed some such plan half a dozen times, but they are too busy to work it.

*a*. "Yes; of course.

*b*. "They cannot be secured without it. I have no shadow of doubt on this point. Teachers of English are not omniscient."

"Ideal instruction would result from having teachers in technical subjects competent to correct the students' use of the vernacular, and determined to do it. To have the students' papers read separately by the technical instructors for their technical content and by English instructors for their English has two drawbacks: (1) It requires a large addition to the teaching force; (2) It implies an unreal separation between style and content. Only one who thoroughly knows what the student is trying to say or should say can tell him how to say it. What is needed is teachers in all subjects who know good English from bad and will insist upon good."

"As I have pointed out, with examples, in one of my papers on the subject, it is possible to state a scientific fallacy in

faultless English. The English instructor is rendering a real service if he sees to it that this is done, for the technical instructor naturally wishes to discover misconceptions if they exist.

*a.* "It does promote it, as an experience of fourteen years with the plan at this institution has shown.

*b.* "Yes. Otherwise, the careless use of written English in non-English courses will almost certainly nullify the efforts of instructors in strictly English classes.

*c.* "Just as feasible as any other sort of team work for a worth-while end."

"We think it impossible to secure really good results in composition unless *all* the instructors insist on good English. . . . The most serious trouble lies in the poor speech of many of the instructors; some of them are unable to correct the style of the reports. We are rather pessimistic at present regarding the improvement of the average college student in English. He has already formed his speech habits, and tends to revert to any bad English he may be accustomed to. But we welcome any plan that might help him to use good English constantly."

"It certainly would. I have long maintained that it is the only way to get certain students to use correct English. I believe it is fundamental. One of the greatest difficulties in the way of such a plan is that so many of our technically trained men do not know correct English themselves, and in many subjects they do not see the need of it."

"In my opinion, decidedly *yes*. It is most desirable, to say the least. The greatest obstacle is that so many instructors in other departments do not put sufficient value on severe accuracy in writing and speaking. Many do not practice in their own writing and speaking this severe accuracy."

"Within limits, I think the plan would be a good one. By 'limits' I mean that English as a subject should not be merged in other courses to the extent that it would lose its own individuality—as is the case, for example, in the coöperative plan in vogue at the University of Cincinnati, and in the 'Citizenship' course in the University of Missouri."

"I regret to say that we have no plan of coöperative teaching of English composition in *use*. Several years ago I prepared a report on the subject. It happened that about this

time we were reorganizing the first two years of college work, and it seemed not to be feasible to bring up too many issues at the same time. I have realized the grave difficulties of putting such a plan into effect, but yet I am convinced that we shall never be satisfied until we have done so. I regard with some envy the accomplishments of other universities in this direction. . . . When you have finished your investigation, I hope you will put us down on the mailing list."

"The close relationship between the engineering subjects and the English course which is suggested in your questionnaire seems to me a most desirable end to be sought; I have little hope of its being attained. . . . Several obstacles lie in the way of bringing about the relations that you suggest.

"1. The schedules of the English faculty are too crowded to permit of any considerable addition to their work in the matter of overseeing or correcting engineering reports. . . .

"2. There is no proper recognition on the part of a considerable number of the engineering men of the fundamental importance of English, regarded merely as an aid to engineering work.

"3. I question seriously the competency of most of the engineering faculty to know what constitutes adequate English usage."

"I am convinced that the plan in use here works well as far as it goes. I strongly believe, however, that some of the written work of every student submitted in the regular engineering studies should pass under the eye of the professors or instructors in the English department; also that occasional conferences and discussions under the direction of the English department should take place regularly after the students have finished their required work in English. As a natural sequel of this plan I should have a grade given each student by the English department, and I should have this grade given when the other grades are given. And the student who betrays weakness in his English, for whatever reason, I should not promote or allow to graduate, although I should furnish opportunity for special work which might help this weakness. . . ."

"I don't believe in any machinery for such coöperation, theoretically; and although I've seen somewhat of its use in various schools, the results have not persuaded me in the least. If the instructors in English are to be merely clerks to mark spelling and grammar for such students as wish to learn

language forms, such machinery might be useful. But instructors in English, according to the notions I have, ought to do much more than that, and in order to do so must have full control of the work in their classes. They must, of course, understand and sympathize in the general work and motives of the school—as must instructors of other departments—and in order to do so they must talk over subjects and methods and aims of school work with other members of the faculty—and help on any kind of work, unofficially. Professors of electrical engineering, mechanics, etc., know what 'well written' means, and often they write better than do the professors of English. Keep their interest, but don't clerk for them. I wish the English Committee would not keep this proposal for mechanical coöperation before the society."

"Yes. Such a plan is not only good but essential to the interests of English, and, in turn, vastly promotes the interests of the technical departments. All written work benefits by it.

"It is fundamental. The best results cannot be obtained without such close coöperation. Only our limited English staff prevents us from grading all technical English. Our colleagues are glad to collaborate.

"Perfectly feasible—provided that the professors of the technical subjects are sufficiently well educated themselves to see the advantages of the plan and are willing to coöperate. . . . The advantages of such a connection are so obvious as not to require discussion, it seems to me. Does any one really question them? I am heartily in sympathy with your investigation."

No effort has been made yet to formulate any conclusions. Obviously, conclusions based upon reports from only fifty-one of the colleges of engineering and technical schools in the United States would be unreliable; but since these fifty-one represent almost every type of school and every section of the country, the opinions expressed in them must carry considerable weight. One conclusion, at any rate, may be safely ventured: A plan that is looked upon by over 91 per cent. as desirable; that is considered fundamental by 70 per cent.; that has been used with success by six different and widely separated institutions; and the feasibility of which is positively denied by only 13 per cent. must have sufficient merit to warrant further consideration.

# JUNIOR COLLEGES.

BY GEORGE F. ZOOK,*

Chief, Division of Higher Education, U. S. Bureau of Education.

During the last few years the junior college movement has been gaining ground in such a way as to enlist the interest of educators all over the country. The growth of the movement may be illustrated by the increase in the number of junior colleges listed by the Bureau of Education. In 1921–22 the Bureau carried 92 junior colleges on its list, whereas in 1924–25 the number was 137, or a gain of 49 per cent. in four years. The Bureau has undoubtedly been conservative in listing such institutions, since Professor L. V. Koos of the University of Minnesota, who has recently written an exhaustive treatment on this subject, recognizes 189 junior colleges.

Junior colleges have perhaps been most discussed in California, Missouri, Minnesota, Michigan and Texas. Other states in which the movement has been under consideration are Virginia, Tennessee, Oklahoma, Kansas, Wisconsin and Illinois. In the southern and border states the movement is as yet chiefly confined to the privately controlled colleges, whereas in California and the North Central States it has been developed from public funds, usually in connection with the public school systems.

Naturally the growth of the junior college movement has called forth a great deal of discussion during the last five years. The Bureau of Education has published two bulletins on the subject. Numerous articles have appeared in the educational magazines. Recently, as has been stated, a very exhaustive treatment of the whole subject appeared in two volumes by Professor L. V. Koos of the University of Minnesota. At the same time the establishment of a system of public junior colleges has been suggested in several states, especially

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in Massachusetts. In that state such a state system of junior colleges was recommended by a survey commission as the next logical step to take in extending the interest of the state in higher education. Finally, the junior colleges, following a conference called by the U. S. Bureau of Education in 1920, formed a national organization which is actively engaged in studying the problems confronting such colleges.

No discussion of junior colleges can proceed very far without some reference to the place of junior college work in a logical scheme of education. As is well known, elementary education and higher education began in this country almost simultaneously, in the very early days. The elementary schools tended to reach upward in their curricula and the colleges tended to reach downward. As a result of this situation, when, many years later, the secondary schools were organized, it was necessary for them to adjust themselves to this situation. Consequently the secondary schools have for a long time been elbowing the elementary schools on the one hand and the colleges on the other, in order to secure possession of the field of secondary education. This situation is represented in part by the junior high-school movement below and by the junior college movement above. When these movements are finally consummated I believe we shall have a system of secondary education at least six years in length which will be far superior to the shortened period of secondary education which now obtains. This system of secondary education will begin at an earlier time in the child's life than is now usual with the four-year high school and it will comprehend much of the elementary work that is now offered in our higher institutions.

So far the junior colleges have devoted themselves largely to the first two years of the liberal arts college. It has been argued, for example, that students can attend public or private junior colleges near home at small expense, and therefore graduate from a four-year college with only two additional years. At the same time the preprofessional requirement for entrance into medical and law schools of two years of liberal arts work naturally emphasizes these two years as

a unit. The junior college therefore appears to find a logical place in our scheme of liberal education as a feeder both to the advanced work of the four-year colleges and to the pre-professional schools.

Whether the engineering colleges should follow the lead of medical, dental and law schools in recognizing a unit of one or two years of junior college work for entrance seems to me to be a question worthy of careful consideration. Certainly the liberal arts work found in the engineering curriculum usually amounts to about two years. For some time the first two years of the engineering curricula at the University of Pittsburgh have been given in the College of Liberal Arts and Sciences. These two years of work are composed chiefly of courses in English, psychology, economics, physics, chemistry and mathematics. If a unit of two years of liberal studies for entrance into professional engineering curricula finds favor, the character of these curricula may be subject to considerable modification in the future, especially if the semi-professional fields of technical education are developed more widely.

The field of semi-professional education is much more extensive than is usually supposed. Ordinarily training for these fields of work requires the completion of a course of study not longer than three years nor shorter than one year beyond high-school graduation. The person engaged in this work must have a technical knowledge that is considerably beyond that of skilled labor, but ordinarily such a person is directly supervised by someone in a professional capacity. The situation can be made more clear by one or two examples. Nurses in hospital or bed-side service require fairly extended technical knowledge in order to perform their work, but they are subject to the orders of the physician or surgeon. The pharmacist has only about the same latitude. The dental hygienist stands in substantially the same relation to the dentist. Library assistants occupy similar positions. Accountants in banks and commercial houses are on the same level. Even teachers who graduate from one and two-year normal courses have some points of similarity. Each of these fields

of work, as well as many others which might be cited, requires from one to three years' training beyond high school graduation. The graduates of such curricula have fairly extensive technical training, but they work under the general direction of someone in a professional capacity immediately above them.

In the engineering field there are of course a number of occupations on the semi-professional level. Foremen in design and construction are excellent examples. Draftsmen and surveyors are others. Indeed they direct or supervise skilled labor, but they are themselves responsible to the professional engineer or architect and have therefore only a limited latitude in which to exercise independent judgment.

With the growing complexity of industry the number of these semi-professional positions is increasing very rapidly. As yet, however, they have not in many instances been clearly identified. Furthermore there is at present considerable disposition to feel that, when identified, they will be filled largely by the more capable men who demonstrate their fitness to hold them by actual experience in the ranks accompanied perhaps by incidental or part-time education. Under these circumstances it is quite natural that little should have been done by the public-school system to train young people to occupy the semi-professional positions in industry and business.

Nevertheless certain progress has been made in the organization of curricula of this type, particularly by the private schools. I refer to the work of Bradley Polytechnic Institute, at Peoria, Ill.; Crane Junior College, Chicago, Ill.; Idaho Technical Institute, Pocatello, Idaho; Lowell Institute, Boston, Mass.; Mechanics Institute, Rochester, N. Y.; and several of the Y. M. C. A. schools such as that at Cleveland, Ohio. This work has been developed partly as full day instruction and partly as late afternoon or evening instruction.

Similar work has been carried on by a number of the land-grant colleges of the country. However, in many of these institutions it has not been very successful, partly because the demand was not sufficient and partly because the work is per-

haps not thoroughly at home in an institution which is primarily interested in the training of men in four-year curricula. For this reason, and others which might be mentioned, it seems to me likely that semi-professional training along industrial and business lines is more likely to be developed in connection with the public school systems of our larger cities. As yet, however, very few of our public school people have grasped the opportunity which is spread before them. It is an obligation which ought to be undertaken at once.

As soon as curricula of this type are thoroughly organized and recognized as a part of the regular educational system, I believe that it will have a very wholesome effect upon the engineering schools. It will have a tendency to make them devote their efforts more largely to training truly of professional grade. Shop work, foundry and drawing will be eliminated as far as possible. The men who desire technical training but who fail in the present engineering schools, can be directed into one of several semi-professional curricula. Our industrial system will then include vocational, semi-professional and professional engineering training to correspond more closely with the present demands of industry and business.

BY L. W. CLARK,

Rensselaer Polytechnic Institute.

Lest some of you gentlemen should receive a wrong impression I want to say that I am not here to speak as an authority on the Junior College, as we at Rensselaer have come into direct contact with it only recently and frankly we do not know how best to handle the problem. However, with the proverbial luck of the novice I may be able to bring up some points or ask some questions, in answering which others more competent than I will confer real help on those who have the Junior College problem before them.

Apparently the Junior College is here to stay. Represent-

ing what is probably the most radical development in education in many decades its growth is quite remarkable. While the Junior College has many problems to solve for itself, it seems to me that the one confronting us involves the question of how much credit should be given for Junior College work, how to determine this for the individual case, and what the requirements should be for the Junior College graduate entering the Senior College.

Information secured from a number of institutions seems to indicate a feeling that the work of the high grade Junior College is fully equivalent to that of the first two years of the Senior College. In nearly all cases, however, these reports have to do with students in the liberal arts or other similar courses in college, and I have found it difficult to ascertain much regarding the preparation for entering the engineering schools.

Most of the published information seems to assume a considerable number of optional studies in the Junior College, whereas the engineering schools have in the first two years a very rigid curriculum. This would indicate that while the Junior College student may complete an equivalent amount of work, it does not necessarily follow that this should be accepted as replacing the required first two years work of the engineering school. Dr. Trenholme, of the Univ. of Missouri, says: "In Missouri we have no provision for Junior Colleges doing in any definite way work of pre-professional or semi-professional character. Our professional schools, especially our schools of agriculture and engineering, are much opposed to work of this nature being done before a student comes to the University. The only Junior College that at present attempts such work to any great extent is the Kansas City Junior College. This has engineering courses which, however, are not given credit in the School of Engineering at the Univ. of Missouri." We thus find that even an institution of the high grade of the Kansas City Junior College is not given credit for engineering subjects by a university which has

been very closely connected with the Junior College movement. I believe that the Junior College of Hibbing, Minn., does give the equivalent of the first two years of E.E., M.E. and C.E. courses at the State university.

Probably one of the principal reasons for the Junior College not undertaking the engineering courses to a greater extent is the expense involved in maintaining a faculty for a small number of students. Such faculty members would not be nearly so interchangeable in the work of the various departments as those teaching English, History and such courses. It is probable that only the larger Junior Colleges such as that at Kansas City would be able to maintain such a faculty.

A great advantage claimed for the Junior College over the Senior College is the small number of students per instructor. While such a comparison would doubtless favor the Junior College over many of the colleges of liberal arts, I am not at all sure that the same advantage would be found if compared with the instructor-student ratio of most of our engineering schools. In most of these emphasis is placed upon this very point, and the very nature of our American system of teaching makes the small sections of classes imperative.

At every point in a student's career where there is a change in educational policy or methods there is always a loss of time and efficiency during the process of adaptation to the new conditions. Does this not mean, in the case of the Junior College graduate, a serious break at one of the most critical periods in his educational career?

In most if not in all of the Arts courses in our colleges, the students are not required to follow a very straight line in the selection of their courses, graduation requirements being based upon the completion of a certain number of hours of work, much of which is optional. The student is thus given a great deal of freedom to satisfy personal choices which may develop. In engineering, however, changes after the first year are very likely to prove disastrous. Changes during the

first year, of which there are many, are influenced largely by environment, and association with upperclassmen and instructors. Assuming that the latter are of the type usually found in our engineering schools, and especially if they are men of wide practical experience in the engineering world, it is doubtful if the student would have the same perspective in the Junior as in the Senior College.

Just as certain schools have acquired a reputation for mining courses because they are located in a mining region, and others, such as Union College, draw large numbers in the Electrical Engineering courses because of proximity with a large electrical plant, so it would seem that in general subjects related to engineering can best be taught by men who are associated with those teaching the more advanced engineering subjects, and who perhaps have more or less of private engineering work to keep them alive to the need of a practical application of theoretical principles. I have often heard engineering teachers express a preference for a boy who *never had a course in Chemistry, Physics* or Trigonometry in preparatory school. Dean MacKenzie, of the College of the City of Detroit, formerly a Junior College, says: "There is great danger in the ambition of high schools to develop Junior Colleges which are no more than extended high schools."

Dr. Trenholme says: "Some analysis and examination of complaints indicates that the teachers in certain departments, notably in English and Mathematics, find Junior College graduates lacking in thorough grounding in subject matter. Private Junior Colleges are often too ambitious to specialize in English, and they fail to demand thoroughness of preparation and accomplishment in mathematics and science."

Another item which we must consider is the elimination of undesirable students. One of the greatest benefits coming from the Junior College is the relief from large classes in the first two years. I believe that the average engineering school eliminates at least 50 per cent. in the first two years. Now,

unless we are doing a great injustice in this, if the Junior College does not eliminate as large a percentage it simply means that our classes in the last two years are going to be fields for this weeding out process, with a resulting drag on the work of these years. The Dean of one of our largest engineering schools says that while Junior College graduates appear to have excellent training, the rate of elimination in the last two years is greater than among the regular four year students. The only figure I have in this line comes from the Kansas City Junior College, where about 30 per cent. of the freshmen complete the two year course.

The Junior College is here to stay, and the great problem for the engineering schools is a just basis for assigning credit to its graduates. In California, where there are over twenty Junior Colleges, the State University goes so far as to make a contract with the Junior Colleges by which the University not only outlines the courses taught, but also passes on the qualifications of Junior College teachers before they are employed. Probably most institutions would have neither the *desire nor power to do this.*

Where geographically possible the plan followed by the University of Missouri seems as good as any. If you will bear with me I shall read extracts from a report thereon by Dr. Trenholme (page 21, Proceedings of the Fourth Annual Meeting of the American Association of Junior Colleges).

The procedure in standardizing and accrediting a Junior College may be of interest to members of this Association who are not acquainted with what we have been doing in Missouri during the last dozen years. The first step is the application from the institution which desires to be inspected with the view to being accredited for its college work and placed on the list of Junior Colleges. This application comes before the general University Committee on Accredited Schools and Colleges and is passed on, favorably or unfavorably, by this committee. The institution making application has to convince the committee that it is ready for inspection on the basis of college standards of work. As the university bears the ex-

pense of the inspection, it desires not to waste its money and the time of its officers in useless trips to institutions not ready for inspection. If an inspection is authorized, a visiting committee, known as the Junior College Committee, is sent to the institution for the purpose of making a thorough inspection of its college work. This committee is carefully selected with the view to the competence of its members for the work in question. For many years the personnel of this committee was practically the same and this insured a uniform type of inspection and uniform standards of accrediting. On arrival at the institution to be inspected, the first business of the committee is to secure information as to the actual class work going on and then to visit all classes possible and see the work of every teacher who is teaching for college credit. A thorough inspection is made of the library, of the map equipment, of the laboratories, and of the buildings and physical environment of the college. Standards of entrance are inquired into, number of hours of teaching required from Junior College instructors, composition of college classes, length of recitation, length of term and other such matters are carefully gone into. The number of academy and college students is ascertained and their separation into secondary and collegiate classes or sections is looked into. Usually at least one day is spent in this investigation which is carried on with the help and cooperation of the school officials. The examiners feel free, however, to talk with the individual teachers and to ask questions of the teacher as to their hours of teaching, their salaries, and their attitude towards their college work. In some cases much valuable data is secured from the teachers themselves particularly where the school is not on a strong basis and is perhaps attempting to make an exceptionally good showing in a general institutional way.

The next step after actual inspection is to draw up reports upon which to base a general report and recommendations to the Committee on Accredited Schools and Colleges. Each examiner makes a special report of the work he observed together with any general remarks or suggestions and submits

this to the chairman of the visiting committee. On the basis of these reports and on his own data, the chairman of the Junior College Committee draws up a general report as to the institution which has been visited and makes a favorable or unfavorable recommendation as to accrediting it as a Junior College. Special recommendations are made as to improvements of various kinds in the organization, administration, or equipment of the college. In case the college inspected is just starting its collegiate work and has only one year of college work in operation, the chairman of the committee may recommend that credit be given for the work of that year and action towards placing the institution on the list of fully accredited and Junior Colleges be postponed until the following year when two years of college work will be in operation. It may be remarked that very few institutions get on the list of fully accredited Junior Colleges after the first inspection, although generally most of their work is given college credit. Certain weak spots are usually found in the matter of teaching or equipment and these weaknesses have to be remedied before the school can be fully accredited. The university is frequently urged to accredit some college on promises of doing everything recommended by the committee, but it has been the policy of the university never to fully accredit an institution until it has met all the requirements laid down by the Committee on Accredited Schools and Colleges. Furthermore, the university does not hesitate to remove from the list of accredited Junior Colleges any institution that fails to maintain proper standards of teaching and equipment or in which the enrollment of college students falls below a certain minimum. The requirements which a Junior College must meet in order to be accredited by the university are as follows:

(1) It must have an enrollment of at least twenty college students of bona fide character, that is, with at least fifteen units of entrance credit from an approved secondary school.

(2) If a preparatory school is maintained in connection with the college, its work must be approved by the university.

(3) The course of study in the college must be two years in length; and the college year, thirty-six weeks.

(4) For graduation from the college, the students must complete satisfactorily sixty semester hours of work, which must be the equivalent of that required in the first two years in the College of Arts and Science in the University of Missouri. (It may be said, incidentally, that one purpose of this work is to supplement the student's high school experience by acquainting him with various general fields of knowledge, thus insuring a general education. Specialization is required in the last two years of the college of arts and science and in the professional schools of the university.

(5) A student's credit must be limited to sixteen hours each semester.

(6) There must be a sufficient number of teachers to conduct the work without crowding the classes, or without assigning to individual teachers an excessive amount or variety of work.

(7) All college teachers should have had training equivalent to not less than four years' work in a standard college, and it is preferable that they should have completed at least one year of graduate work.

(8) There must be a laboratory for physical science and a laboratory for biological science, each adequately equipped and sufficiently large to permit easily of individual work upon the part of students.

(9) There must be an adequate library and map equipment.

(10) The college must give satisfactory instruction in the subjects specified as requirements in the first two years of the University College of Arts and Science; and, in addition, must give satisfactory instruction in other approved courses which the student may take in completing the sixty hours credit necessary for graduation from the Junior Colleges, which may be added, have decided in most cases to confer the degree of associate in arts.

If all the above requirements have been met in a full and satisfactory way, the university will ordinarily accredit the institution on the basis of specific subjects taught each year. No blanket credit is given and each student from a Junior Col-

lege entering the university must submit an individudal certificate of credit. The university has arranged to coöperate with the State Department of Education and with outside agencies, such as the North Central Association of Colleges and Secondary Schools and other similar bodies, in regard to acceptance of credit for professional work and for advanced standing. The subjects accepted by the university for credit must, in general, conform to the standards of the first two years of the college of arts and science as organized to meet the needs of preparation for upper class work. This may cause some hardship and difficulty in regard to the development of a Junior College course of study complete in itself. The university feels, however, that there is danger in departing from accepted standards of college credit and that any excessive credit in music, fine arts, expression, home economics, education, vocational studies and technical training is unwise and out of harmony with the purpose of the Junior College movement as representing the equivalent of the first two years work of a college of arts and science. In all matters regarding credit the university seeks to maintain a liberal yet sane attitude.

This method would, however, be of small assistance in passing on the qualifications of a Junior College in a distant part of the country.

Many Colleges are accepting Junior College credits without reservation or examination for the Arts courses, and a few for the Engineering courses. One Dean of Engineering suggests that they be given credit in languages and general science, but be required to pass examinations in mathematics and any technical subjects for which credit is asked.

As stated at the beginning I am not here to advise, but as I see it now the visitation plan of the University of Missouri is the most feasible, affording as it does an opportunity for examination of the number of students, standards of teaching, library and laboratory equipment, and scholarship of the faculty. It is possible that the difficulty of geographical distribution might be worked out on a coöperative basis by

some such organization as the S. P. E. E., each engineering school becoming responsible for inspection and report on the Junior Colleges in its vicinity.

I should summarize the points in this paper as follows:

(*a*) The engineering school occupies a different relation to the Junior College from that of the College of Arts.

(*b*) Does the Junior College course cover the required subjects of the first two years in the Engineering School?

(*c*) Does a comparison of instructor-student ratios favor the Junior College?

(*d*) Is there not serious danger from a break in the student's career at this point?

(*e*) Can the student choose his course as well in the Junior College as in the environment of the Engineering School?

(*f*) Is the quality of instruction in the Junior College equal to that of the Engineering School?

(*g*) Is the elimination of undesirable students effectively accomplished in the Junior College?

(*h*) What is the best plan for accrediting Junior College graduates?

# PERSONNEL WORK AT THE UNIVERSITY OF MAINE.

BY W. J. CREAMER, JR.,

Acting Dean, College of Technology.

(Incorporated in this article are: (1) The Progress Report of October 10, 1924, which was presented at the New England Meeting of the Society for the Promotion of Engineering Education held at Burlington, Vermont; (2) The Progress Report of March 1, 1925; and (3) Studies made since the latter date.)

The Personnel System of the University of Maine's College of Technology has now been in existence for a year and a half; and the accumulated data are now beginning to point more definitely to the accomplishments and shortcomings of the system as first established.

We may restate our objectives as follows:

First, we wish to be able to give a detailed and accurate recommendation of every student who is graduated from our College of Technology.

Second, we wish to be in a position to advise the student better while he is in college, so that he may make the most of his opportunities by exercising to the fullest degree his special capabilities and by overcoming his weaknesses.

Third, we wish to eliminate educational waste by recognizing as soon as possible the misfits, and sorting our material into groups of

*a.* Engineering Caliber.
*b.* College but not Engineering Caliber.
*c.* Non-College Caliber.

Every step toward the attainment of these objectives is, we believe, to be a distinct service to society, a service to the students themselves, and to the parents, whose sacrifices deserve not only that their sons shall compensate them by satisfactory accomplishment, but also that they shall be guided to that accomplishment by an organized plan which shall so place

and train the individual that the world may obtain from him a maximum of social service.

While Personnel Work is not new in the industries, there had been hardly anything of the kind done in collegiate education at the time of the institution of the system at the University of Maine; and the whole personnel structure established was therefore experimental at the start, and still is so for the most part.* It is not the purpose of this article to give in detail the mechanics of the system, as these are contained in the "Outline of Personnel System," copies of which may be obtained from President H. S. Boardman; but rather it is the purpose to indicate some of the work done thus far, to discuss the shortcomings of the student and his training as revealed by our collected data, and to point the way, it may be, toward somewhat effective methods in collegiate education.

In our statistical studies we are using five different grades:

1. The Subject Grade Average.
2. The Recommendation Grade Average.
3. The Personal Report or Interview Grade.
4. The Personal Rating.
5. The Intelligence Quotient (I. G.).

The last four of these grades are referred to as predictive indices of the accomplishment which the first eventually measures.

The Subject Grade is an average of a student's accomplishment in his classes.

The Recommendation Grade is the average of five grades obtained from recommendation forms, three of which are filled out by faculty members and two by student associates. These forms attempt to measure such qualities as Mental Caliber, Initiative, Leadership, Character, etc.

The Personal Report or Interview Grade attempts to measure the student's breadth of interests and to uncover his deficiencies. Items such as extra-curricular activities, artistic tastes, hobbies, preferences, and prejudices are included.

* We are however, indebted to Purdue University for many valuable ideas derived from their personnel system.

The Personal Rating is a weighted average of the three previous grades.

The Intelligence Quotient is the ratio of mental to chronological age, and is determined by psychological tests for every Freshman.

All grading, except in the case of the last item is done in a 4-point system, in which 4 = 100 per cent., 3 = 90 per cent., 2 = 80 per cent., and so on. This system was adopted because it is in line with the existing system of averaging student grades, and because of the convenience in handling small numbers.

The information collected on the various forms is summarized and entered on two large Personnel Cards for each student. These cards are our permanent records.

To summarize the accomplishments of the system and to evaluate them is an exceedingly difficult task.

The establishment of a *Personal Rating* for each student is undoubtedly stimulating. The parents of the highest ten in each class are written a personal letter of congratulation by the Dean. This list is published in the press. And then too the student takes an unholy interest in knowing that it is possible to "make" this list without being an honor student, though few do. But more valuable are the various facts learned in the process of obtaining this rating.

In regard to the success of the forms being used, we have sufficient information now to warrant the statement that in general they are satisfactory. The one exception to this was the blank first devised for the Personal Interview or Personal Report. During the year 1923–24 the Subject Grade Average for all classes was 1.9, the mean Recommendation Grade was 1.8, whereas the Personal Interview or Report Grade was only 0.1. All four classes obtained practically the same average in the first two indices, but there was a wide divergence in the mean Personal Report Grade for the three upper classes and the mean Personal Interview Grade for the freshman class, the latter being much higher. The Personal Report and Interview forms were, therefore, revised for the year

1924–25, being made more nearly identical and more objective in form. The average grade for the freshman class (1928) has thereby been raised to 2.3; but the sophomore average is only 0.9, and the junior average only 0.6. The tabulation below facilitates comparison.

AVERAGE FRESHMAN INTERVIEW AND UPPERCLASSMEN REPORT GRADES FOR TWO DIFFERENT BLANKS.

| | 1923–24, Original Form. | 1924–25, Revised Form. | Increase Due to Revised Form. |
|---|---|---|---|
| Freshmen | +0.8 | +2.3 | 1.5 |
| Sophomores | −1.0 | +0.9 | 1.9 |
| Juniors | −0.8 | +0.6 | 1.4 |
| Seniors | −0.9 | | |

Thus, although the revision of the blanks has resulted in a fairly uniform increase in grade, the marked difference between the freshman average and the average of the upperclassmen of approximately 1.6 has been maintained. This difference is therefore judged to be a characteristic one. In view of the similarity of the blanks for all classes, the lower grades for the upper classmen apparently indicates either (1) that the upper classman is reticent about recording his accomplishments while the personal contact with the Freshman draws out the best that is in him; or (2) that the upper classman as he specializes more and more in his chosen field of work, withdraws from campus activities, cultural interests, etc., which this form measures, and which the Freshman in the first burst of college and class spirit are so prone to enter upon. It is suggested too that the diversity of interests in the case of a Freshman, which gives him this higher grade, may remove him from college on account of accompanying scholastic difficulties, and thereby reduce the versatility of the class when it reaches the sophomore year.

The questions on the Personal Interview blank (fall semester 1923) revealed that our Freshmen were woefully deficient in knowledge of good books and magazines, and even of

current events. A surprisingly large number had never heard of the Bok Peace Plan, or of the Religious Controversy in the Episcopal Church, which topics were occupying so much space in the newspapers at that time.

Of the Freshmen (Class of 1927) 72 per cent. admitted having some difficulty with their studies during the first quarter (this difficulty meaning usually a grade of D, E, or F at Mid-semester). Of this number 38 per cent. stated with apparent sincerity that their difficulty was due to poor preparation in high school; 7 per cent. criticized our own system of instruction; 25 per cent. assigned inherent inability as the cause of the difficulty; and 30 per cent. admitted neglect of their work. This is not an especially good recommendation for the Maine preparatory schools from which we draw 90 per cent. of our students. I believe the figures are truly indicative.

But Maine may not be the only state at fault. The President of the New York State College for Teachers says: "The high school is a refuge from hard work, an opportunity for social diversion, and a place where one gets along on a minimum of effort," and Dean West of Princeton says: "The first place for attaching the problem of reconstructing *college* education is in the secondary schools. Until our secondary schools are put in order, the confusion in college education will continue." The Dean of one of the largest high schools of the state, on being urged to give more English Composition work so that our Freshmen drawn from that school, would at least avoid the more common blunders, replied: "The high school is the college for many students; and we must emphasize literature instead of composition, because this is of greater value to the majority." It is granted that this is true; but such a course should not be dignified by the name of college preparatory.

We have made some correlation studies with our collected data, but with insignificant results. The Intelligence Quotient has been correlated with our various grades. The Pearson coefficient for

| | |
|---|---|
| I. Q. and Personal Interview is | 0.20 |
| I. Q. and Recommendations is | 0.39 |
| I. Q. and Fall Semester Subjects is | 0.49 |
| I. Q. and Freshman Year Subjects '28 | 0.52 |
| I. Q. and Sophomore Year Subjects '27 | 0.38 |
| I. Q. and Personnel Rating | 0.54 |
| I. Q. and Junior Grades Class '26 | 0.39 |

The highest correlation found is 0.57 between Recommendations and Subject Grades for Freshmen, this being accounted for by the fact that two, and in some cases three instructors responsible for the subject grades were also responsible for the recommendation grades of a given student.

The recommendations from student associates give a much lower correlation with Subject Grades than do those from faculty members, the figures being 0.29 and 0.57.

It is interesting to note the fairly high correlation of 0.54 of I. Q. with Personnel Rating. Are we measuring then with our Personnel Rating the same thing, to a large degree, that is measured by the I. Q.?

The low correlation of I. Q. with the other variables can only mean that the students do not perform according to their ability; and when we consider the number of interests other than scholastic which our students have placed before them, we can only marvel that the correlation is as high as it is.

Our correlation studies, rather than revealing any method of predicting general scholastic achievement, have shown the futility of trying to predict it from such indices as are now being used.

Frankly we are not expecting much from our statistical studies other than the establishment of certain standards, and the correcting of certain faults in our general system. For at best the relations hold only in the average. The variation of the individual from the average is enormous; and it is just here that the personnel officer must take up the problem where the statistician is forced to drop it. The personnel officer can make use of statistical methods, but he must never forget the individual; and his problem is not to fuse him with the

mass average, but rather to separate him *from* the mass and discover why he differs from the average.

Giving up for the present the idea of predicting accomplishment in general, and restricting ourselves to the prediction of failures in college work has been somewhat more fruitful of results. It was felt that by proper consideration of the three indices, Personal Interview Grade, Recommendation Grade, and I. Q., a high percentage of failures in college work might be predicted; and accordingly a study of the failures was made with reference to these three indices. It was found at the outset that the group of students who failed to attain satisfactory scholastic grades generally averaged as high as the successful students in the separate indices. Another study of the variation in the average I. Q. of three classes for three years was made, the results being indicated in the table below.

AVERAGE INTELLIGENCE QUOTIENT.

| Class of | Freshman Year. | Sophomore Year. | Junior Year. |
|---|---|---|---|
| 1926 | 109 | 109 | 110 |
| 1927 | 106 | 108 | |
| 1928 | 104 | | |

A slight tendency is noticed toward a higher I. Q. with each succeeding year. Apparently the men of low I. Q. are weeded out more than those of high I. Q. A really significant rise in the average I. Q. is undoubtedly masked by the large number of students who drop out for other reasons than that of lack of mental ability. A steady decline in average I. Q. for Freshmen in the past three years is also indicated by the table, in spite of the fact that our entrance conditions have continually demanded a higher high school record. These small differences, however, may be due to variability in the intelligence tests. But we may also question whether or not high school standards have dropped faster than our entrance requirements have risen.

The fact that low I. Q. alone cannot be used to predict

scholastic failure is indicated by the following table, which lists the number of students having an I. Q. below 100.

NUMBER OF STUDENTS HAVING I. Q. < 100.

| Class. | Freshman Year. | Sophomore Year. | Junior Year. |
|---|---|---|---|
| 1926 | 20–11*s* | 14–8*s* | 10–6*s* |
| 1927 | 28–18*s* | 16–7*s* | |
| 1928 | 41–17*s* | | |

The first figure in each column is the total number of students having an I. Q. below 100. The second figure, followed by the small *s*, gives the number from the total who have a satisfactory scholastic record. The mortality of the low I. Q. men is greater than the mortality of the whole class in the cases of the class of 1927; but less in the case of the class of 1926. A similar table for those students having an I. Q. below 90 follows.

NUMBER OF STUDENTS HAVING I. Q. < 90.

| Class. | Freshman Year. | Sophomore Year. | Junior Year. |
|---|---|---|---|
| 1926 | 0–0*s* | 0–0*s* | 0–0*s* |
| 1927 | 7–1*s* | 4–2*s* | |
| 1928 | 8–3*s* | | |

A similar tabulation for those students having low Recommendation grades reveals slightly lower percentages of satisfactory scholastic achievement.

NUMBER OF STUDENTS HAVING RECOMMENDATION GRADE LESS THAN 1.75 IN 1923–24.

| Class. | Freshman Year. | Sophomore Year. | Junior Year. |
|---|---|---|---|
| 1926 | | 30–10*s* | 19–8*s* |
| 1927 | 70–27*s* | 39–15*s* | |
| 1928 | 44–15*s* | | |

A tabulation for those students having low Personal Interview grades gives only slightly higher percentages of satisfactory scholastic achievement in spite of the fact that the Personal Interview Grade is not intended to be directly predictive of this.

NUMBER OF STUDENTS HAVING PERSONAL INTERVIEW GRADE LESS THAN 1.75 IN 1923–24.*

| Class. | Freshman Year. | Sophomore Year. | Junior Year. |
|---|---|---|---|
| 1926..... | | 33–16s | 25–14s |
| 1927..... | 53–29s | 34–18s | |
| 1928..... | 41–18s | | |

* Based on grades corrected to mean of 2.0. Figures for class of 1926 based on Personal Report, since no interview was held with members of this class.

After considerable experimentation it was decided to form a list of all students who rated low in two of the three indices, the assumption being that these students would in all probability be unsuccessful in their college work. A summary of these lists for three classes follows.

PREDICTION OF FAILURE TO ATTAIN SATISFACTORY SCHOLASTIC STANDING BASED ON TWO LOW INDICES OUT OF THREE.
(Personal Interview—Recommendations—I. Q.)

| Class. | Predicted Failures.* | Correct Prediction. | Incorrect Prediction. | No Prediction. |
|---|---|---|---|---|
| 1926... | 27 | 23–85% | 4 | 4 |
| 1927... | 51 | 37–73% | 14 | 29 |
| 1928†.. | 39 | 25–64% | 14 | 31 |
| | 117 | 85–73% | 32 | 64 |

* Indicates average below 1.75 in studies.
† Based on Mid Year Grades.

On the basis outlined above, using sophomore indices (freshman indices not available) twenty-seven men were picked from the class of 1926 as probable failures. From this

list only four men have made satisfactory scholastic records. This list had then a predictive accuracy of 85 per cent.

A similar list from the class of 1927 comprised fifty-one men on the basis of freshman indices. From this list fourteen men have made satisfactory scholastic records. This list had then a predictive accuracy of 73 per cent.

The list from the class of 1928 comprised thirty-nine men on the basis of freshman indices. From this list fourteen men have made satisfactory scholastic records. This list had then a predictive accuracy of 64 per cent.

From the 1926 list 11 men dropped at the end of the sophomore year.

From the 1927 list 20 men dropped at the end of the freshman year.

In the class of 1926 (now Juniors) there are 4 men with poor records about whom no prediction of failure was made.

In the class of 1927 (now Sophomores) there are 29 men with poor records about whom no prediction of failure was made.

In the class of 1928 (now Freshmen) there are 31 men with poor records about whom no prediction of failure was made.

The relatively high accuracy of prediction for the class of 1926 is probably due to the fact that this class has been subjected to academic elimination for a longer period of time than the others.

If we form our lists of those men who rate low in all three indices we have the following results:

| Class. | Predicted Failures. | Correct Prediction. | Incorrect Prediction. | No Prediction. |
|---|---|---|---|---|
| 1926... | 4 | 4–100% | 0 | 23 |
| 1927... | 10 | 7– 10% | 3 | 59 |
| 1928... | 13 | 10– 77% | 3 | 45 |
| | 27 | 21– 78% | 6 | 127 |

The predictive accuracy of the second list is somewhat greater than the first, but it fails to include too many of the poor students.

It is proper to inquire here (1) why these lists are not 100 per cent. accurate, and (2) why there are so many failing students about whom no prediction was made. The answer to the first of course is that our indices are at best imperfect and that intense application to scholastic work may yield a measure of accomplishment far in excess of that suggested by any predictive index, for conscientious effort will surely overcome handicaps of heredity, environment, and habit. The answer to the second similarly is that our indices are imperfect and that the possession of ability is no guarantee that it will be used.

If we could not only measure a student's ability, but also predict the proportion of it which he would use, we should indeed have achieved a standard of judgment.

The fairly high predictive accuracy of the lists as shown would indicate that immediate use might be made of these indices, while further study with a view to increasing their accuracy is being carried on.

Furthermore, it may be seen that our three predictive indices may be determined during the last year in the preparatory school; and in fact a university committee on Educational Research is at work on this matter, and Dean Hart of the University is interviewing prospective candidates for admission. We are thus reaching back into the preparatory school for our indices; and the question therefore presents itself, will we not be justified soon in even refusing admission to those applicants with unsatisfactory predictive grades? The answer to this question can be made only after careful experimentation.

A real step forward is the very brief interviews with Freshmen, first held at mid-semester of the spring term 1924 and continued thereafter at each grade period. Instead of reporting to the Dean of the University to obtain their grades, the freshman engineering students now report to the Dean and his Assistant. At this time we have before us the student's Recommendation Grade, his Intelligence Quotient, his Personal Interview Grade, and his Subject Grades for the

period under consideration. By inspection of these records the cause of any failure in scholastic work can be quickly determined, as experience has shown, with a high degree of accuracy. This, of course, does not mean that we can immediately correct the existing conditions; but we can, without any beating around the bush, isolate the particular failure germ, and give some advice straight from the shoulder. To the man with a high I. Q. and a poor scholastic record, we can say, "You're loafing." And time after time this blunt statement will draw a frank admission. The Personal Interview record showed if extra curricula activities were at fault; for in boasting of exploits in football and glee club, the student was unwittingly giving himself away. This record showed also deficiencies in reading which accounts for a great many failures in English. In the case of several students, a high I. Q. indicated ability in spite of poor scholastic record not accounted for by lack of endeavor. Here the assumption was that these men did not possess the engineering type of mind. A few questions would disclose an awakening of interest in some other department of study; whereupon we would urge consultation with the head of that department with a view to making the transfer. We don't have to guide many students in this fashion before we have justified our system.

Another item of the work may be of interest. During the past summer, the records of all men were reviewed, and a sheet of recommendations prepared for the officers who registered upper classmen for the fall semester of 1924. These sheets were divided with vertical column headings as follows:

Urged to Over-register,*
Permitted to Over-register,
Regular Curriculum,
Warn of Low Standing and Advise to Under-register,
Warn of Low Standing and Compel to Under-register,
Prescribe Cultural Work,
Recommendations show Undesirable,
I. Q. shows Undesirable.

* More than regular curriculum.

Each student was checked off in one or more of these columns. This gave the officer in charge of registration an idea of the student's personnel record, and was in reality a recommendation from the Dean in regard to the amount of work to be attempted in the next semester.

This scheme recognizes the individuality of the student. It recognizes the fact that some students need more than four years to complete their course. It says that those students should distribute their work over five years and complete it without failures, rather than crowd a full schedule into each one of the five years, repeating in succeeding years subjects which he has previously failed in.

This scheme recognizes also that the brilliant students can carry the regular work with less effort than the average; and attempts to maintain a level of effort by encouraging those subjects to elect other than the required subjects, in particular those subjects which will contribute to the cultural side.

And so it may be that out of this recommendation sheet will develop a compulsory system of distributing the hours of a curriculum so that all students, the brilliant and the slow and the average, will be held at a common level of effort. Under such a system there would be fewer failures; and if eligibility for campus activities were denied to those students with reduced schedules, there could be no lowering of educational standards.

An ideal should be established, specified somewhat as follows: Junior and Senior classes absolutely free from incompetent students, so that rarely any grade below passing need be given; this condition to be brought about by the refusal of major instructors to register for advanced work those students who have not cleared a prerequisite, even if such a refusal means a five-year course for those students.

It is evident that the present methods of placing students on trial are not satisfactory. We have our lists of those students who are warned, those who are placed on probation, those who are placed on probation and who are likely to be dropped at the next grade period (the P. L. D. list). It is proposed

that a new list be established. This list would be called the Observation List. On it would be placed (1) all students who rated low in two of the three predictive indices; (2) all students who attain an I. Q. lower than 90; (3) all other Freshmen reported by any instructor after the first four week's work as likely to fail; (4) all upperclassmen whose previous grade average was below 1.5. A student could remove himself from this list by attaining an average of 2.0. The Freshmen on the list should have added to their schedule a conference period with the Dean or his Assistant once in two weeks. Upper-classmen would be scheduled for similar conferences with their major instructors. A report form should be filled out for each conference and filed in the office of the Dean. This form should attempt to get at the student's difficulties, his attitude toward the work, the conditions under which he studies, etc.

The objects of such a procedure would be two: (1) The reduction of the mortality rate by reclaiming some students who without advice and attention would drift with the crowd of incompetents; (2) The elimination from the college rolls of the hopelessly incompetent and indolent students more quickly than can be done at present, so that the junior and senior classes may be free from their retarding influence. The attainment of the latter object will of course depend upon new administrative procedure.

Justification for the speedy elimination of the low ranking students may be questioned, but when we consider that those students who withdraw early in their course after struggling along with indefensible records for several semesters have wasted an enormous amount of time in attempts at preparation for a specialized endeavor which they are never to pursue, that they could have advanced further culturally by an equal amount of time spent in a public library, that their expenditure of money far exceeds the economic value of the education received in that short period (for it is only in the third and fourth years that returns on the educational investment begin to come in), we are forced to the conclusion that speedy elimi-

nation is desirable. It is not denied that the student who withdraws early in his college course has derived some benefit from his college work; but it is felt that the benefit to the student is not in proportion either to the time and money which he has spent or to the educational investment made by the institution; and that the engineering college is justified, therefore, in refusing to carry the burden of the incompetent student, or the competent student who refuses to use his ability.

The major problem of our college, in common with many others, is the high mortality rate; and into this a host of minor problems merge. For this high mortality rate one of two things must be responsible: either we are admitting too many incompetent and unadaptable students; or we are not properly directing the performance of those admitted. The thought often comes to mind that it is not worth while to push along the students who do not have enough self-discipline to bring themselves to heel and do the tasks assigned them; but after all it is probably the duty of the college to cultivate that self-discipline in its students if it has not already been brought to light. We can perhaps remember students to whom in addition to engineering principles we have taught self-discipline and self-reliance.

Our Personnel System at the University of Maine is a recognition of the individuality of our students, the variability of the human species. We have only begun to collect our data; and until we have a fair amount, our findings must necessarily be forced, and a large part of our effort of little value. We are trying to assume a little more responsibility. We are trying to make the way of our engineering students not easy, but well defined. We are trying to break down their prejudices and narrow-mindedness, so that we may graduate not mere technicians, but men possessing a fair degree of culture; men of integrity as well as of keen intellect; in short, men who shall truly deserve the name of "a college graduate."

## OBITUARY.

### Earle Jay Babcock.

Earle Jay Babcock, Dean of the College of Engineering of the University of North Dakota, died suddenly September 3, 1925. He was born June 11, 1865, at St. Charles, Minnesota, graduated from the University of Minnesota in 1889 and began work at once on the faculty of the University of North Dakota. His department at first was Chemistry and Geology, which changed with the growth of the institution until now it was Industrial Chemistry, Mining and Metallurgy. He was the first State Geologist of North Dakota, from 1897 to 1902. He was Acting President of the University in 1917–18. His researches and investigations for the development of the natural resources of the State were in many different lines of chemistry and geology, but were particularly extensive in the study and research for methods of manufacture or use of natural cements, lignite coals and pottery clays.

Dean Babcock has been an active member of the Society since 1907. At the time of his death he was a member of the Council.

## SECTIONS AND BRANCHES.

The first meeting of the **Minnesota Section** for the year 1925–1926 was held at the Minnesota Union, October 27th. President R. E. Kirk, presiding, 42 members present at 5:45 dinner.

F. J. Kelly, Dean of Administration of the University of Minnesota, addressed the meeting on "Liberalizing Engineering Education."

Dean Kelly divided all educational instruction into three parts, according to the purpose for which the subjects were being taken by the student.

1. Tool subjects, used as instruments to obtain further instruction,
2. Cultural subjects,
3. Vocational subjects,

and discussed the logical selection from the standpoint of the student, the method of teaching, and the type of instructor best suited to teach each class.

Interest in Dean Kelly's address was manifested by the discussion which followed, Professors Rowley, Mann, Roe and others taking part.

The meeting adjourned at 8:15 P.M.

B. J. ROBERTSON,
*Secretary.*

Over fifty attended the first meeting of the **Purdue Branch** on November 9, 1925. The Department of Mathematics acted as host and entertained the group in its rooms in Recitation Hall.

Chairman J. A. Needy introduced Dr. William Marshall, Head of the Mathematics Department, who presented a summary of the Math. I grades for a period of ten years. The figures showed that a constantly increasing proportion of non-passing grades had been given during that interval. Pro-

fessor Marshall offered three possible explanations for this fact. The first two, higher standards and poorer teaching, were rejected as unlikely to be progressively present in such magnitude as to account for the results obtained. The third and perhaps the true one was the belief that we are receiving progressively poorer prepared students who come to undertake a serious advanced study of mathematics. He stated the outstanding characteristics of the present entering freshman to be a lack of discrimination and the inability to generalize.

Mr. C. F. Barr of the Mathematics Department then presented a study of the correlation between the scores made in Iowa Aptitude test and the grades in Math. I for the year 1924–25.

The scatter diagram included over seven hundred individuals and showed a coefficient of correlation of .741 with a probable error of .015. Especially in the extremely high and extremely low grades the success or failure in Math. I was accurately predicted.

From the distribution of the grades in this year's aptitude tests he predicted excessive mathematics mortality in the group of men entering deficient in solid geometry.

Professor C. T. Hazard then presented a study of the records of the Math. I "repeaters" since Sept. 1919. During this period 81 "repeaters" sections involving 1,575 men showed 942 passed and 633 not passed on second trial.

Following this he presented a more detailed study of the first four groups where elapsed time permitted graduation. In these groups of 131 men repeating Math. I, 88 passed and twelve finally graduated, though not without several further repetitions.

His figures on costs of instruction were also of interest. Where passing students gain a semester hour credit for a semester hour before the instructor; the average run of students get 80 per cent. of an hour and repeater students get 45 per cent. In other words, it costs more than twice as much to teach failures as successes, measured in terms of credit hours secured.

The last paper was presented by Professor T. E. Mason who discussed the teaching of Integral Calculus; developing first the uses and applications, and then pointing out that the solution of the problems must be preceded by the drudgery of learning the processes.

After some general discussion Chairman Needy called on President Edward C. Elliott who discussed three questions prompted by the discussion of the evening. That we should constantly impress upon our students that fundamental subjects such as mathematics are the necessary equipment for any man who expects to engage in scientific work, whether physical, biological or social.

That in case the student fails to take advantage of the opportunities offered with resulting non-passing grades, both justice and economy dictate that subsequent opportunities be paid for by the student himself.

That every department should closely scrutinize every course offered to be sure that in the light of modern requirements and demands all is worth learning that is required to be learned.

Chairman Needy then announced that the other meetings of the year would be held with other departments of instruction, the Modern Language Department to have the next meeting in charge.

GEORGE W. MUNRO,
*Acting Secretary.*